## NEW ORDNANCE MATERIAL.*

**Official Report to the U. S. War Department.**

BY WM. H. BIXBY, CAPT. OF ENG'S., U. S. ARMY.

(*Concluded from page 386.*)

**New Methods of Protection Against Moisture.**

*Celluloid Lining for Ammunition Cases.*[1] The French Government in 1881-2 were experimenting with the use of celluloid for a waterproof covering of powder cases.

A rough wooden box was painted inside with one coating of celluloid. It was then filled with nitric acid, and left for 24 hours; when then examined, the wood was found to be entirely untouched by the nitric acid. It is thought that the celluloid will prove so excellent a water-proofing for powder cans and cases, that there will be no further trouble in keeping powder dry, even in the dampest localities.

*Cork Paint for Exposed Iron Work.*—All the interior exposed iron work of the Dreadnought, and of many other British ships of war, are painted with "cork paint." The results were so satisfactory that the material is recommended for use on all metal work, such as roof girders or lamp tubes, in the magazines of land fortifications. This "cork paint" or cork composition is made by "dusting powdered cork on to a coating of red-lead and oil."[2]

The writer saw this paint being applied to the interior iron work of a British war-ship both at Sheerness and Chatham in 1882. The red-lead and oil appeared to be more than usually thick, and was applied with great liberality, and received immediately its coating of dry powdered cork; the powdered cork varied in size from that of large bird-shot up to that of split peas, and was pressed against the iron work with a float until no more cork would stick to the freshly painted surface. The paint was to be allowed three days for drying; after which the outer cork surface itself was to receive a heavy coat of white lead and turpentine; after another day's drying it was to receive a coat of distemper. This method of painting was stated both at Sheerness and at Chatham to give excellent results, and to be far superior to the somewhat similar Welch's wood-faced cement used on the Inflexible. It formed an excellent non-conducting surface, and thoroughly prevented the moisture from dripping from or even beading upon the iron work. One grinding machine at Plymouth was said to furnish powdered cork enough for all the British ship yards.

*Cork Composition for Floors of Magazines.*—The success of cork paint on walls led to its use in England for floors of magazines. The following description,[3] fully explains its use.

"With a view to diminish the condensation which takes place on the surface of asphalte or concrete in magazines, the surface can be covered with a mixture of four parts of Venetian red lead, made thoroughly into a stiff paste with Stockholm tar. This material should be laid with a trowel to a thickness of one-eighth of an inch, and, while wet, should be covered with powdered cork, sifted over it to a thickness of three-eighths of an inch, and pressed down with a float and roller. The powdered cork can be obtained from any large cork dealer.

It is capital stuff and is used both by the War Office and the Admiralty. It is much used for covering the smooth surface of asphalte floors, which condenses moisture a great deal. In this case it is necessary to protect it by batten flooring laid over it, so that it may not be rubbed off by the traffic. It might prove a good thing to cover all the walls and arches of a damp magazine with cork composition as well as the floor, but this has not yet been tried."

*Ventilation of Magazines.*—The valuable article[4] of Lieut. Ardagh, Royal Engineers, on the ventilation of magazines, submitted to the Committee on Fortifications in 1869, led, in England, to regulations[5] by which the magazines were to be opened only when the temperature of the magazine was higher than the dew point of the outside atmosphere. This rule is at present in use almost everywhere. In order to enable the ordinary soldier to follow out these regulations with certainty, Germany has adopted the simple arrangement proposed by Mr. Cohausen and called the Cohausen-psychroscope. It is described and used as follows:—

*Cohausen Psychroscope.* The psychroscope consists of a german-silver mirror on the end of a long stick; this stick carries a wooden handle in the form of a disc; the disc is large enough to completely close an opening in the magazine wall through which the psychroscope is introduced by a person standing outside of the magazine.

The psychroscope is used as follows:—A small wooden door, habitually closing the opening into the magazine through which the psychroscope is to be introduced, is opened and the psychroscope is thrust into the magazine, great care being taken to see that the handle completely closes the opening through the wall. The psychroscope is left in its position a sufficient length of time for its disc to acquire the temperature of the air on the inside of the magazine. The psychroscope is then withdrawn, and held in a position where it will not be exposed to the sunshine or draft, and watched.

The following cases may then present themselves:—

First: the mirror may be covered with dew when withdrawn. If the dew disappears within a minute, open the magazine. If the dew does not disappear within a minute, do not open the magazine.

Second: the mirror may be free from dew when withdrawn. If the dew forms on the mirror within a minute, do not open the magazine. If the dew does not form on the mirror at all, it is necessary to breathe on the mirror so as to form an artificial dew by means of the breath. If this artificial dew formed by the breath disappears immediately, open the magazine. If the artificial dew formed by the breath does not disappear within a minute, do not open the magazine.

This psychroscope is exceedingly simple, and the rules for its use equally simple. With them the ordinary soldier or workman has no difficulty in keeping the magazine walls in a constantly dry condition.

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[1] Statement of Mr. Rapp, agent of Hyatt Celluloid Manufacturing Company, Paris.

[2] See page 113, Vol. 7, Prof. Papers Royl. Engrs., 1882.

[3] Quoted from Lewis, p. 113, Vol. 7, Prof. Royl. Engrs. for 1882.

[4] To be found in pages 142 to 146, U. S. Engrs. Prof. Papers, No. 21, 1871.

[5] See page 240, Army Equipment Regulations, London, 1881.

## London Sewage Disposal.

At the meeting of the Metropolitan Board of Works on November 27th, the Works and General Purposes Committee presented a report as to the steps the committee were taking under the reference by the Board on the subject of the metropolitan sewage discharge: "The committee, in pursuance of the references made to them by the Board, have for some time past had before them the subject of the disposal of the sewage of the metropolis, and in the consideration of this large question they have had the assistance of a sub-committee, who have given it great attention, and have made the fullest inquiry into the details of the various proposals which have been placed before them. The committee have also, under the authority of the Board, given directions for the carrying out of experiments on a large scale at the pumping station at Crossness. They have themselves visited that station and witnessed the experiments in operation, and have thereby satisfied themselves that by chemical precipitation of the sewage a good effluent water can be obtained. In this view it may be stated they are supported by the independent opinions of eminent chemists who have been specially consulted on the subject. The committee are now pursuing their inquiries as to the best method of dealing with the residue or sludge, and having carefully examined the several suggestions which have been submitted to them, they are of opinion that it may ultimately prove that the best means of disposing of the sludge—at least until the discovery of some method by which it may be rendered commercially valuable—will be to convey it out of sea. They have had before them proposals with this object from two gentlemen—namely, Mr. J. O. Phillips, manager of the Gas Light and Coke Company, and Mr. J. Casey. The former suggests that the sludge might be taken out to sea by the gas company's coal steamers as ballast on their return voyages, and Mr. Casey offers to take it away at a fixed cost per ton and to discharge it in mid-channel. Each of these proposals, however, involves an outlay much larger than it appears to the committee it would be necessary to incur, in the event of its being ultimately decided to adopt this method of disposing of the sludge. In order, therefore, to enable your committee definitely to ascertain at what cost the Board could carry into effect this disposition of the whole or part of the sludge, and with the least possible delay to gain practical experience upon this important point before a large expenditure is incurred, they beg to submit the following recommendation: That an advertisement be issued inviting designs and estimates for the construction of one vessel capable of taking out to sea 1,000 tons of settled sludge daily, such advertisement to state that, in the event of the Board not accepting any of the tenders, a premium of 500*l.* will be given for the design which may be considered the best. The committee also recommend that letters be addressed to Mr. J. O. Phillips and to Mr. J. Casey thanking them for their communications on the subject of conveying the sludge out to sea, but stating that their terms are too high for the Board to entertain, as they have reason to believe that the sludge, whether pressed, or in its crude state, can be dealt with in a much less expensive manner."

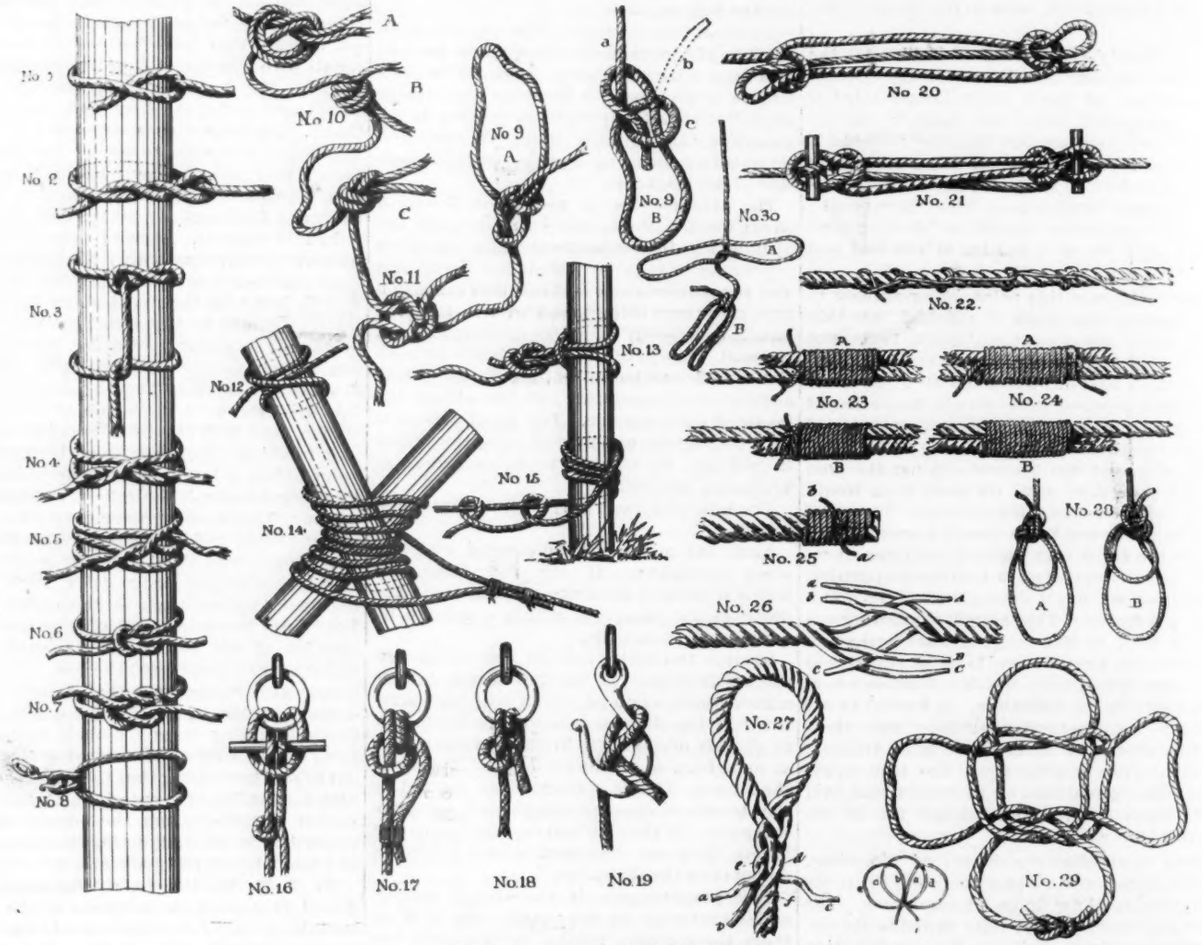
Mr. F. H. Fowler, deputy-chairman of the Board, in moving the adoption of the report, said the result of the experiments which had been made showed that the effluent water could be obtained from metropolitan sewage sufficiently pure to be discharged into the river Thames, and the question which the Board had really to deal with was how the sludge or residuum of the sewage was to be got rid of. Three propositions for effecting this object has been laid before the committee. One of them was by drying and burning the sludge; another was by compressing it into cakes and disposing of it; and a third was by putting it into barges and discharging it into the sea. The committee had not decided to adopt either of these operations permanently, but merely to make one experiment for the purpose of ascertaining whether a vessel could be constructed from which the sewage could be discharged under water, instead of being thrown overboard.

The motion was unanimously agreed to.

NEW LOTS SEWERS.—At a meeting of the new Lots, L. I., Board of Health, to obtain the views of taxpayers, all were in favor of a sewerage system.

## Knots for Engineers.

A knowledge of the handling of ropes, while not absolutely essential, will still be found exceedingly useful to the civil engineer in the diversified demands of his calling. It is with this object in view that we give this week a few of the more common knots, etc., that may be found handy for the landsman, and such description of their use and manner of making as letter-press will permit. We do not expect that the engineer student will at once acquire the handy twist of the wrist and fingers peculiar to the "old salt," and which can only be acquired by long practice; but we will encourage him by saying that the art once attained is not easily lost, and his knowledge will often come into play when he least expects it.




KNOTS FOR ENGINEERS.

In the illustrations given, Fig. 1 is a simple hitch around a mast or stick, it is useful but will not stand any very great strain. If further security is required, Fig. 2, or a "Timber-Hitch," can be used; this is made by tucking the free end of the rope several times under the standing part as shown and forming a loop which holds by the friction of its parts against the stick the harder it is strained. Right here it is well to state that the ruling principle in making knots and fastenings among sailors is to so lay the rope that they will be secure for the purpose intended, will not slip or jam and can be readily untied when no longer needed. An examination of the knots, etc., presented, will show how carefully this point is considered, and how fully the fact is appreciated that a hard knot, or a slip or jam in a rope might, at some time, cause loss of life or the wreck of a vessel.

Fig. 3 is a "Timber-and-Half-hitch;" this is usefully and efficiently applied in towing a long timber, as it cannot slip and pulls the stick fairly on the line of its axis. The strain on the rope makes the cord underneath hold fast because of the friction between it and the object round which it is tied. This friction increases in the same ratio as the strain, and no force will *untie* it. Fig 4 is a "Builder's" knot. It is used by workmen in connecting building material or scaffolding; it cannot come undone when any strain is upon it. Fig. 5 is a "Double Builder's" knot which is still stronger. Fig. 6 is a "Square" knot, useful for many purposes, it may be used around an object as shown, or in connecting the ends of a rope or ropes. This is also called the "Sailor's" or "true" knot; it is mostly used with small ropes and is not applicable for uniting ropes of different sizes, as it will slip by drawing out one of the parts; this can be prevented, however, by fastening the ends to the standing parts by yarn or twine. Fig. 7 shows what is called a "Granny" knot, that is the "Square" knot improperly tied; it is comparatively useless and will form a knot difficult to untie when a strain comes upon it.

Fig. 8 is a "Strap" for slinging a case, barrel or other object. This "strap" is made in various ways; the ends may be simply tied; they may be spliced by a "long" or a "short" splice, or the strap may be made of rope yarns wound about some fixed points giving the required length, and of a number of turns or strands sufficient to give the strength needed; this endless coil of rope yarns is then secured by being tied at intervals, or by having yarn passed around its entire length in close contact.

Fig. 9 is a "Bowline," the "King of Knots." Two views are shown giving the back and front of this knot in 9 *A* and 9 *B*. It is much used in making fast to mooring posts, as it can be thrown lasso-like over the post, and it will not slip or jam. To make it, take the part *a* in the right hand and lay *b* over it, then by a twist turn in the half-hitch *c* in such manner that *b* passes through it; finally pass the running end *b* around the part *a* and down through the loop *c* and draw it tight. Fig. 28 shows two views of a "double bowline"; this is often used to hoist a man up along a mast, as he can pass the smaller loop around his body under the arms, and sit either directly in the larger loop or on a short, notched board resting in it. It is made by first forming a long loop with the end of the rope and then using the end of the loop in the same manner as *b* was handled in Fig 9 B, excepting that in this case the half hitch *c* will be also double, and the end of the loop must be passed down over the double main loop and up against the standing part represented by *a* in Fig. 9, which standing part will likewise be doubled as shown. To get the loops of different lengths, work them to to the required position before the knot is tightened up.

Fig. 10 *A*, *B*, *C*, is an "Open hand" knot for uniting the ends of two ropes quickly; it will never slip or untie, but when the ropes are to be subjected to great strain it may part at the knot. *A* shows the way in which it is commenced; *B* and C show the two sides of the fast, or completed, knot.

Fig. 11 is a "Weaver's" knot, or a "sheet" bend when used with larger rope. It is one of the simplest and best knots for uniting two ropes, or attaching one rope to the middle of another, as shown in the figure. Fig. 12, is a "clove" hitch or "waterman's" knot; it is useful for fastening to a post; it is the same

as a "builder's" knot in form, but in this case is made by turning two half hitches into the rope, and passing them over the end of the post. Fig. 13 is a "larkshead," fastened to a running knot. Fig. 14 is a fastening to the top of shears, and Fig. 15 is a tie or bend to a mooring post.

Fig. 16 is a "Larkshead" on the ring of a boat. This knot has advantages, as it can be released *instantly* by pulling out the pin which constitutes the knot. Figs. 17 and 18 are fastenings to a hook or ring; the first is a "Fisherman's" bend, the second is a "round turn and half hitch"; both are useful and secure fastenings. Fig. 19 is a "Blackwall" hitch for fastening a rope's end or a chain to a hook; as will be seen any weight applied to the longer end binds the short end against the hook.

Figs. 20 and 21 show methods of shortening a rope, for any hauling purpose, without cutting it. Fig. 20 is a "Sheepshank" or "Dogshank"; it can be made still more secure under heavy strain by tying the "shanks" to the ropes with stout yarn. Fig. 21 is another shortening form.

Fig. 22 shows the way in which a heavy rope can be secured by the use of a lighter one while the end of the heavy line is being shifted, as occasion might require. Figs. 23 *AB* and 24 *AB* are bands or ligatures for lashing together two heavy ropes; the views *A* and *B* show the two sides of the knots. Fig. 25 is intended to prevent the strands of a rope from untwisting and thus becoming unserviceable. It is made by passing the first few turns over the end *a*, thus securing it; and either passing the last three or four turns over a small round stick, so as to enable the end *b* to be passed under them; or, in working at the end of a rope, the end *b* can be laid alongside the rope and the parts of the loop passed over it until the end is reached, when the whole can be pulled tight by drawing on *b*.

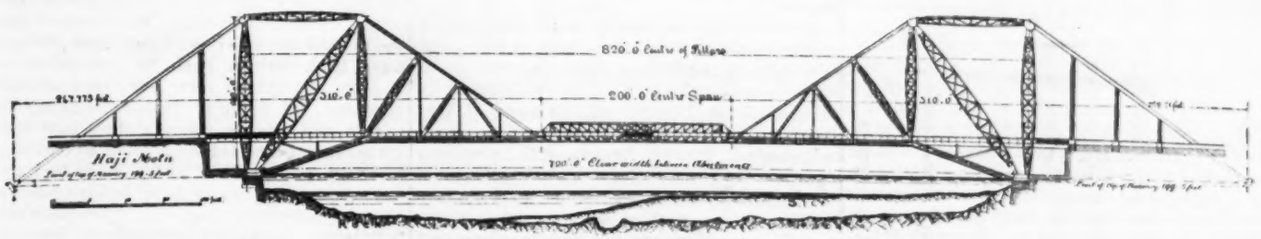
Fig. 26 is the beginning of a "short-splice" in a three-stranded rope. This splice is rather difficult to explain by a diagram; the two ropes are first untwisted for a certain distance and then the two ropes are set up against each other, with the two sets of strands interlacing as in the figure, but closer than there shown. The strand *b*, for instance, is then passed over *B* and under *C*, and *A* is passed over *a* and under *c*; this is done for each strand of the six and repeated once or oftener. A pointed wooden or iron instrument called a "marling spike" or a "pricker" etc., is used in opening the twists and passing the strands. Fig. 27 is an "Eye-splice" formed on the end of a rope on much the same principle that a "short splice" is made. Practice alone, or personal teaching, will explain these splices more plainly.

Fig. 29 has various names, the more common one is "The True-lovers" knot. It is useful sometimes in furnishing guy attachments to a mast, the latter passing through the central opening and the guys being tied to the four loops. To make it, first turn three half-hitches, the one over the other, as in the side figure; then pass the part *a* under *b* over *c* and under *e*, and at the same time pass *b* over *a*, under *d* and over *f*. The size of the loops can then be regulated to suit the purpose intended and the fourth loop is made by tying the ends in a square knot as shown.

Fig. 30 *A. B.* is a very convenient rolling hitch for attaching the end of a rope to the hook of a block for hoisting, or other similar purpose. It is made by first throwing a loop at the end of a rope over the standing part, as show at *A*. Then bringing the two parts of the loop together at the middle and rolling up the rope over it two or three times; bring the two loops thus made together, as at *B*, and insert the hook. This hitch will neither slip nor jam, but requires a strain upon it to keep it together; it will loosen by a shake when the hook is removed.

### The Sukkur Bridge over the Indus.

In our issue of January 10, 1885, we gave a description of the Attock cantilever bridge over the river Indus, and illustrations of the false works used. We now give a view of the Sukkur bridge over the same river, with some descriptions of its peculiar features.




THE SUKKUR BRIDGE OVER THE INDUS.

The bridge is on the line of the Indus Valley Railroad, and it crosses the river where it passes through a bed of limestone rock, divided into two channels by Sukkur Island. The Rohri channel is crossed by a cantilever span of 280 feet between bed-plates; the bridge over the Sukkur channel is in three spans of 278, 238 and 94½ feet respectively; these latter are steel semi-parabolic girders, 28 feet deep in the center, and 12½ feet at the ends of the two larger spans.

In the cantilever span, the clear span between abutments is 790 feet; span between centers of bed-plates, 820 feet; clear center span, 194 feet; extreme height of cantilever from under-bed-plate, 40 feet; length of back guys, 280 and 300 feet: width of bridge between centers of main members at bed-plate, 100 feet; width of bridge between centers of main members at ends of cantilevers, 20 feet, and width between centers of back guys, 20 feet.

The bridge is for a single line of railway of 5 feet 6 inches gauge. It is to be entirely constructed of mild steel plates and bars, ranging from 1¼ inches to 5-16 inch in thickness, riveted together with steel rivets. The long struts are rectangular in section, each corner of the rectangle consisting of a curved plate, with angle bars on its edges, and the faces of the rectangle being occupied by transverse and diagonal bracing. Lengthwise the struts are curved on all four faces, tapering from the middle towards the ends. The roadway girders are of steel plates 4 feet 6 inches in depth, and at a uniform distance of 20 feet apart; the cross-girders are spaced 8 feet apart. The floor of the bridge is of corrugated steel plating.

The back guys are, of course, more heavily strained than any other members; the stress provided for in each of the two guys of the cantilever amounting to 1,200 tons. This stress arises from a load of 300 tons on the nose of the cantilever, imposed by the center span, from the dead weight of the cantilever itself, from a rolling load covering the cantilever, and from wind.

The anchors are buried in a large mass of concrete, and are built up of steel plates and angle bars. Each anchor measures 32 feet by 12 feet in a plane at right angles to the line of stress. The total weight of steel in the two cantilevers (including the back guys and anchors, but not including the central span) is nearly 3,000 tons.

The river pier between the two large spans was built in 9 feet of water, at low-water stage of the river, running with a velocity of about 6 miles an hour. A coffer dam was made by sinking iron rails in holes bored in the rock about 6 or 8 feet apart; to these walings were fastened and sheet-piling driven between. The inner wall of the dam was made by wooden frames 9 inches thick and 9 feet square let down from above, and the space between these and the piling (5 feet) filled with 2 feet of concrete at the bottom and "gutch" above. The dam was water-tight.

The staging or false-work, used at the Attock bridge, was again employed here. The cost of the two coffer dams was 16,385 rupees and the cost of labor in erecting the ironwork of the bridge was 43,549 rupees. The smaller span of 278 feet was erected in "only five days." This bridge was designed by Mr. A. M. Rendel, Consulting Engineer to the Indian Government, and was built by Messrs. Westwood, Baillie & Co., Poplar, England. We are indebted to the London *Mechanical World* and the Abstracts of the Institution of Civil Engineers for the above data.

### European Mechanical Arts in Asia.

From Japan, that outpost of Oriental civilisation, the *Japan Mail* brings news of a significant character, which will prove somewhat disappointing to the hopes of Western industrial communities. The statement is made that preparations are now in progress for manufacturing rails for the Japanese railways, which have hitherto been imported, in the Osaka Arsenal, in Japan. An Italian engineer employed in that establishment has, it it is said, already made some rails, which proved in no way inferior to those imported. Those first made are to be used for the requirements of the arsenal, after which the wants of the railways will be supplied from the same source. The important results that may arise from the introduction of Western mechanical arts into Asia, have as yet hardly been taken fully into account, and the above instance is perhaps a foreshadowing of them. The dexterity, patience, and industry of the people of India, China, and Japan, and the excessive cheapness of their labor, may, when supplemented by the mechanical appliances of the West, ultimately raise them to the position of formidable competitors with European industry. The advantages, therefore, that western countries will derive from the extension of their civilisation are very much open to question, and future generations may have reason to deplore the introduction of European arts into Asia, especially the use of steam power and machinery for spinning and weaving. By so doing important markets will be opened for a time to the iron trade of England, Belgium and perhaps France, in supply

ing engines, machinery, and rails. But the subsequent effect of the change that will be brought about in the habits of hundreds of millions of frugal, intelligent, and persevering people, put in possession of improved instruments of labor, should not be ignored, and may justify the apprehension of M. Leroy-Beaulieu, an eminent French economist, that the initiation of the Chinese alone into the discoveries and mechanical arts of Europe "may bring about one of the most immense revolutions in the history of humanity." In considering this question it should also be remembered that competition, the cause of so much harassing anxiety and disaster in enlightened countries, never disturbs Asiatics. Trade, production, and prices are all regulated by the Guilds, which have reduced the whole business of life to an unvarying system; while the incessant strikes and quarrels between labor and capital, and the pitiless mortal rivalries between communities, cities, firms, and individuals, that characterise life in Europe and America, are in the Far East unknown.

### The Government of Cities.

The government of cities is a difficult problem in politics. Everywhere comes the same complaint of the imperfection or worthlessness of municipal institutions. From Cincinnati recently we have been assured that merchants are leaving that beautiful city because its election are carried by violence and fraud, and life and property are no longer secure from its corrupt politicians. New Orleans has long been governed by its worst classes, and its finances are in perpetual discredit. Even Boston, once the most prudent of cities, has lost much of its reputation under its recent rulers. Chicago has nearly reached the unfortunate fame of Cincinnati. Philadelphia is no longer spotless; even its famous water-works have fallen into decay. And San Francisco and St. Louis continue the melancholy story. From all our large cities comes the same complaint that the better citizens are driven out of the government, and that only the corrupt and the inefficient administer the immense interests of the civic population.

New York for thirty years and more has been one of the chief victims of bad government. Its story is in the highest degree instructive. Within thirty years its debt has arisen at times over one hundred and fifty millions; of this the Sinking Fund represents a payment of nearly forty millions. It is probable that nearly one hundred millions of the debt is the result of fraud. With honest or careful rulers our city need have no debt at all. But to this fraudulent outlay must be added the excessive expenditures of each single year, the sums lost by unnecessary or wasteful contracts, the extravagant salaries, the wild projects, the secret frauds, that have followed for so many years our corrupt government. It is in vain to lament the past. Yet it is well to remember that these lost millions—lost by our own neglect—would long ago have provided the city with a new aqueduct, new docks and piers, a complete sewerage, a new atmosphere, and abundant health.

The health of the city is what our rulers have seemed least to care for. They have sent countless children to an untimely grave, and cut off manhood in its strength, and old age in its decay. New York, that might be made the healthiest of cities, has a higher death rate than any of its American neighbors. In the British Islands it is only exceeded in unhealthiness by Dublin, and perhaps Cork. In Canada, Montreal, with its conservative ignorance, may carry off the fatal palm. In Europe, even Paris and Berlin are more carefully guarded from disease than New York. London is far before us, the healthiest city of Europe, as Dublin is probably the most unhealthy, a center of contagion, the victim of ignorance and neglect.

For it is no doubt certain that ignorance is the chief foe of good Government in nations or in cities. A recent correspondent of the London *Times* has traced with great courage and intelligence the course of the cholera in Spain. He finds that it is due everywhere to the neglect of the Government and the blindness of the people. The disease fastened upon Marseilles, Toulouse, and all Italy for the same reason. It will go wherever it is invited. The recent plague in Montreal is of the same origin. It comes almost exclusively to the ignorant. Thus ignorance is the chief crime of modern society. It provokes disease, it fosters vice and beggary, it produces corruption in politics, and accounts for much of the bad government of our American cities. Our ignorant classes, like those of Spain or Montreal, invite every moral and physical disease; from them the corruption spreads until it poisons those who seemed invulnerable against it.

Yet the American cities are at least better governed than were the cities of the past. The cities of the Middle Ages were centers of disease and crime. The Paris satirized by Rabelais, the London of the days of Wat Tyler, or even of Queen Anne, were no pleasant abodes. Plague, famine, filth, vice, and shame reigned in the finest capitals of Europe. The cities of Italy in its fairest period were scenes of assassination and cruelty. Milan and Florence were covered with murders and outrages; a Bridge of Sighs represented the doom of Venice. The German cities were fortresses, the home of a dawning improvement. The Dutch cities led the way to cleanliness and good order. In the Roman and classical ages the municipalities were scarcely more fortunate. Rome itself abounded in crime, misery, oppression, pestilence, and unrest. Its pauper population supplanted the free citizens. In the far East we have the story of the virtuous Brules nearly starving to death a whole board of aldermen (or senators) to wring from them his usurious interest, of Cicero painting the endless sorrows of the provincials. The cities of China are crowded and noxious beyond belief, the centers of endless discomfort and perpetual diseases.

Compared with these cities of the past or present, even Cincinnati, or New Orleans must seem almost an earthly paradise. But what all our cities want is a vigorous impulse toward reform. We have, in fact, many of the agents of reform—the schools, the civil service rules, the growing power of science, the influence of a rising intelligence. But we still want the union of the more prudent citizens in one unpartisan movement for the common weal. Can we not have in each city a reform league made up of a majority of the voters?—*Harper's Weekly.*

### A Remarkable Drainage Enterprise.

Few people are probably aware of the great engineering undertaking, in which Russia has been engaged for years, of draining the Pinsk marshes. These are so extensive as to secure special designation on the ordinary map of Europe, being, we believe, the only case of the kind; and, in point of area, are very much larger than Ireland. Situated on the Russo-Polish confines, they have become famous in Russian history as a refuge for all manners of romantic characters, and have remained an irreclaimable wilderness in the midst of a prosperous corn-growing region up to within the last few years.

In 1870 the Russian Government first took in hand seriously the abolition of this wild expanse, which, owing to being perpetually more or less submerged and covered with a jungle growth of forest, prevented not only communication between the Russian districts on either side, but also between Russia and Austro-Germany. Consequently, a large staff of engineering officers and several thousand troops were drafted into the region, and these have been engaged upon the undertaking since. Up to the present time about 4,000,000 acres have been reclaimed, thanks to the construction of several thousand miles of ditches and of canals so broad as to be navigable for barges of several hundred tons burden. Just now the engineers are drawing up the programme for next year, which comprises the drainage of 350,000 acres by means of the construction of 120 miles of ditches and canals.

Of the 4,000,000 acres already reclaimed, 600,000 acres consisted of sheer bog, which has been converted into good meadow land; 900,000 acres of "forest tangle," which have been prepared for timber purposes by cutting down all the underwood and thinning the trees; 500,000 acres of good forest land—forest oases in the midst of the marshes—hitherto inaccessible, but which have been connected more or less by navigable canals, and thereby with the distant markets; and finally 2,000,000 acres have been thrown open to cultivation, although only 120,000 acres have been actually occupied up to now. Besides making the canals and ditches, the engineers have built 179 bridges, bored 152 wells from 40 feet to 80 feet deep, and 425 from 20 feet to 40 feet, and have made a survey of 20,000 square miles of country hitherto unmapped. When their task is finished, Russia will have effaced from the map of Europe one of the oldest and toughest bits of savage nature on the Continent, and a few years will suffice to render the Pinsk marshes undistinguishable from the rest of the cultivated region of the sources of the Dnieper. From an engineering, geological, and scientific point of view, generally, the work is one of special interest, and capable globe trotters, anxious for a novel theme, might do worse than spend a few months amidst the fading Pinsk marshes, describing the changes.—*Engineering.*

### New Zealand Parliament.

It will be remembered that when the previous mail left, the session of Parliament had pretty nearly concluded its labors, and the most important business had been disposed of. A resolution proposed by Captain Russell, member for Hawkes Bay, had been carried, directing that the Public Works Estimates presented by the Government, should be cut down by 500,000*l*. The House, therefore, on considering the Estimates in detail, struck off a number of the largest works proposed. Some of the contracts on the North Island Trunk Railway were withdrawn, the expenditure proposed to be made on the Otago Central was curtailed, and other works were postponed. It was decided not to authorize the borrowing of any more money. Nothing more will, therefore, be done in this way till after the next session. We find it stated that it was indeed, one of the features of the session that the House manifested a determination to put an arrest on the tendency to extravagance which had been manifested in New Zealand. The House also showed itself determined to resist all attempts to get it committed to gigantic speculative undertakings meant to serve territorial interests, but calculated to impose serious responsibilities on the Colony. The most conspicuous of these was the East and West Coast Railway. It would have been a great calamity to the Colony if the Ministry had succeeded in persuading Parliament to giving a sanction to so gigantic and unprofitable a project. The prorogation of the Assembly took place on Tuesday, September 22nd. The general verdict was that Parliament had done well in checking the spirit of extravagance, and curtailing expenditure. But it was a surprising fact, as connected with

the session, that while Ministers were foiled in almost all their proposals, even on all those matters on which they had avowedly taken office, they were still allowed to hold office.—*Colonies and India*, Nov. 27th.

### The Abt System of Rack-rail Roads.

The following description of the construction and application of the Abt system of rack-rail road has been translated for ENGINEERING NEWS from a German pamphlet issued by Messrs. Rinecker, Abt & Co., of Würzburg, Germany:

The first rack railroad was built near Leeds, (England), by Blenkinsop, and was opened to traffic on August 12, 1812. Though the superstructure and the engine were of clumsy construction, the road was operated for more than twenty years. A second road was built, near Madison, Ind., in 1847, and was in operation until 1868, when expensive repairs in the cast iron rack-rail, and the unfavorable engine construction caused a change to the adhesion system. The third application was on the Mt. Washington Railroad, commenced by Sylvester Marsh in 1866 and opened in 1869. The latter road inaugurated a new era in the rack-rail system; it was the first to use the wrought iron ladder-rail, and was the prototype of the Rigi Railroad.

The first man to introduce the rack-rail system into Europe was Herr N. Riggenbach, of Olten, Canton Soleure, Switzerland, with his Vitznau Rigi Railroad, opened in 1871. Since the last named date about 45 kilometres (28 miles) of the rack-rail lines have been built in Europe. The grades upon them range from 30 to 250 metres per kilometre (160 to 1320 feet per mile), while the Mt. Washington R. R. has a maximum grade of 377 metres per kilometre.

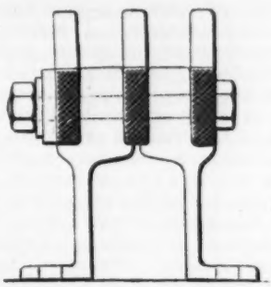
The rack-rail used on all these lines differs practically little from the original ladder-rail, though it has been improved. The round cogs have been replaced by those of a trapezoidal form and with involute gearing; the wooden ties have been abandoned for iron chairs, and for turn-tables have been substituted traversing tables similar in their application to ordinary railroad switches. The very simple device of Herr Alexander Lindner, now of the firm of Rinecker, Abt & Co., has been lately adopted.

To meet the demand for a combination adhesion and cog-wheel system, an adhesion wheel is now carried on the axle of the cog-wheel, and is used in spite of many faults.

A rack-rail system for a main trunk line was first suggested in 1876 and vigorously discussed. Though proposed for the St. Gothard Railway, and its feasibility and economy acknowledged, the interested parties could not make up their minds to adopt it. For such main line purposes the ladder-rail has certain defects inseparable from it; the chief trouble being that it is impossible to consume on lesser grades the full power of the locomotive by increasing the velocity; while on the steeper gradients the lesser velocity, owing to the increase of traction, would necessitate a multiple gearing with all its disadvantages.

The ladder-rail, in its present shape, has reached the maximum of pressure to which it can be subjected, and it is impossible to strengthen it without seriously interfering with the pitch and contact of the cogs. And it was to meet this difficulty that the new system to be described was devised.

Herr Roman Abt, who was for many years the mechanical constructor of Riggenbach's enterprises, noticed the past difficulties and devised for their solution a rather simpler form of rack; and by laying several racks side by side it became possible to secure a better grip for the cog-wheel; with a wheel of less diameter and an increased velocity, he avoided the multiple gearing entirely, and reduced the entire rack-rail mechanism to its simplest form. With this new system the adhesion principle and the cog-wheel can be economically and efficiently combined.



The Abt rail (see figure) consists of several longitudinal toothed bars, of wrought iron, wrought steel or malleable cast steel, fastened by iron chairs to the iron or wooden sleepers of an ordinary road-bed. If rolled bars are used, the teeth can be punched, milled, bored, sawed, or struck out by dies, either in a hot or cold state. The chairs are made of rolled wrought iron, or cast steel, according to the expected traffic, and in height vary with the altitude of the rack-rail. The rack-rails are laid so as not only to break joint with each other, but also with the teeth slightly advanced, or stepped. The number and strength of the bars employed is determined by the pressure on the teeth, which is dependent on the weight of the train, its velocity and the gradient.

The advantages of this new system over the former ladder-rack are apparent.

1. Owing to the alternate grip of the wheels, the rack-rails are equivalent to a continuous structure; there will always be one or more solid bars in contact, and the rail expansion, which formerly gave trouble, will be equalized.

2. The position of the stepped teeth causes the simultaneous grip of many teeth of the cog-wheel on the several bars and an increased security against the breaking of any one tooth, making an accident of this character of little consequence.

3. Both of these conditions permit an easier movement in the engine, with less gearing, than was possible on the ladder-rail, and the velocity can consequently be increased from 20 to 25 kilometres (12½ to 15½ miles) per hour with ease and safety.

4. The open construction of the rack-rail reduces the possible accumulation of snow, mud, etc., more than was the case with the ladder-rail, and its construction admits of the attachment to the engine of an apparatus for sweeping off the rack.

5. The fastening to the ordinary wooden or iron sleeper is simpler and cheaper, and any portion can be readily renewed.

6. Curves of any desired radius may be used without difficulty, for the same bars can be used there as in the straight portions, which is not the case with the ladder-rail.

7. Crossings and switches can be made as simple and safe in operation as those ordinarily in use, and the construction of the "entering-rail" is such that the change from the ordinary to the rack-rail road can be made without stopping the engine.

8. By changing the number and strength of the bars, the rack-rail may be cheaply adapted to the various grades of a railroad.

9. The new system is also more economical, as the stepped teeth allow the direct grip of a cog-wheel of lesser diameter and greater velocity, and the expensive multiple gearing with its constant lubrication is dispensed with.

With this rack-rail Herr Abt has also constructed a combination cog-wheel locomotive, in its general arrangement similar to the Engerth engine. Its advantages are easy motion; accuracy in operation; facility for passing sharp curves and the ability to run in either direction.

The front of this engine rests upon three adhesion axles, each capable of sustaining 10 to 14 tons. One of these axles carries a loose cogged brake-wheel, with two brake-rods, which in case of accident can be applied to check the train on the rack-rail should the driving cog-wheel become disabled. The tender carries the cog-wheel axle and the driving-wheel in the center, and two brake-rods on the ends which serve at the same time as crank-pins and counter-weights. Power is supplied to the driving axle by two small steam cylinders on the tender frame, steam being supplied from the boiler through a pipe with a universal joint. If a greater power of traction is required, two driving cog-wheels are added to the engine, the steam cylinders to operate them being placed over those intended to work the ordinary adhesion wheels.

The driving cog-wheels are so constructed as to have some elasticity allowing a slight motion in the cogs, controlled by springs; this device provides for any slight inequalities due to manufacture or expansion from changing temperature. On steep gradients the cog-wheels can be used to assist the adhesion wheels, without any fear of one interfering with the other. The unequal working of the two systems together was one of the great defects of engines formerly used when both wheels were driven from one shaft.

This engine can be run to a velocity of 60 kilometres (about 37 miles) per hour on the ordinary adhesion sections, and up to 25 kilometres (about 16 miles) on the rack-rail sections. Such an engine with an average working weight of 46 gross tons and at a speed of about 8¾ miles per hour will (excluding its own weight) haul a train of

| | | | | | | |
|---|---|---|---|---|---|---|
| 370 | tons | on a grade of | 160 | feet | per | mile. |
| 235 | " | " | 210 | " | " | " |
| 135 | " | " | 320 | " | " | " |
| 85 | " | " | 420 | " | " | " |

The fuel required while doing this work and the operating expenses will be less than by any other system of engine.

The Abt rack-rail system can be applied to main lines by combining the adhesion and rack mechanism; and in mountainous regions enables the location to be more nearly and economically adapted to the topography. Even on ordinary roads with steep gradients the rack-rail would permit heavier loads to be hauled up these grades than are possible when adhesion only is depended upon. Two of Abt's locomotives will draw a train up inclines of 132 feet per mile, which required two heavy freight engines to bring to the rack-rail portion of the line over grades of 48 feet to the mile.

For private lines for industrial purposes the Abt system seems also well adapted, as roads can thus be built through a country whose topography would make any other system prohibitory from its great cost. It is also recommended as an improvement in the matter of safety on cable roads on steep inclines; and as a substitute for hoisting cranes when a horizontal as well as a vertical distance must be traversed.

*Note*: An illustrated description of the Abt system as applied to the rack-rail road in the Hartz Mountains is found in the "Swiss Construction Gazette," Vol. VI. p. 25. Another road of this description is the Hoellenthalbahn in the Black Forest, Baden, Germany. Neither of these roads are mentioned in the pamphlet above.—ED. ENGINEERING NEWS.

A LARGE METER FOR THE BROOKLYN ELEVATED R. R.—The Long Island Water Supply Company, of East New York, placed a water meter, capable of delivering one thousand gallons of water per minute in the yard of the Brooklyn Elevated Railroad on Saturday last. The cost of the meter was $900.

ENGINEERING NEWS Three Months for $1.50

## Tall Chimney Construction.*

THE USE OF LIGHTNING-CONDUCTORS AND HOW TO USE THEM.

There is no doubt that a great amount of danger to life and property of all kinds is attendant on lightning storms. This was particularly made apparent in previous years, before lightning-rods were applied and from the fact that since the discovery of the lightning-rod, and the beneficial results which were soon found to follow, the matter, of how best to avert this source of danger, has engaged the attention of the governments of all civilized States.

The most eminent scientific men have been asked to instruct the several governments on this subject, and they all agree that the lightning-rod of Franklin, when properly applied, is a perfect safe-guard to all kinds of structures against the destructive effects of lightning-storms. The instructions issued by the Inspector General of Fortifications (Great Britain), and which have been adopted by the American and other Governments, are the most lucid and comprehensive, and these we found upon in the instructions which follow.

The following are a summary of the rules which should be observed in applying a conductor:—

1st. That it should be continuous in all its parts.

2d. That it should be placed in close contact with the building, or other object to be protected, and should on no account be insulated by glass or earthenware.

3d. That it should be led several feet above the highest point of the building.

4th. That all piping and metal on roofs should be connected with it, and in a case where more than one conductor is required, they should be all connected together, either above or below the surface, the piping and other masses of metal in the line of probable discharge being also connected.

5th. That it be properly connected with the earth, terminating in a large metal surface and be sufficiently deep into it, according to the degree of moisture in the soil, so as to secure the complete dispersion of the lightning.

For ordinary small buildings one conductor will generally be sufficient, say of not less than one-half inch diameter copper rope. It should be erected at the end, the point rising at least two feet above the chimney. A horizontal conductor should also be added along the ridge. It should be fixed close to the buildings, and should have no joints, if possible, in the whole of its course. Special attention must be given to the chimneys in all buildings, because they are virtually tubes lined with a carbonized conducting material, the more so if there are fires below sending up a conducting column of warm air. The warm air really invites a discharge from the cloud; hence it is that when lightning enters a house, it is generally by the chimney.

For larger buildings a rod should be placed at each end, at intervals of from twelve to fifteen yards along its length, the roof and chimneys being protected as before. It is important to join any metal on the roof with the conductor, or in the case of tiles, by running a length of rope along. Instances come to our knowledge where the building is struck at some distance from the conductor. ecently the gable of a church was struck, although a conductor was on the spire. A building forty feet long should have two conductors, as a rule, and if one hundred feet or more, three conductors. Larger and more complicated buildings should be protected on similar principles, having rods at each corner and rope along the ridge, all being properly connected with the earth. Separate "earths" should be provided for each, if necessary.

The War-Office Instructions have the following with reference to powder magazines: "When large quantities of explosives are stored in underground magazines, such as the main magazine of a fort, they should be fitted with lightning-conductors on the same principles as ordinary magazines above ground. The same rule holds good as regards underground magazines situated on prominent points, the top of a hill for example, under which circumstances like precautions should be taken—magazines of small extent underground need not, as a rule, be provided with lightning-conductors. Casemated batteries of modern construction, in which the magazines are distributed throughout the basement story, must be provided with lightning-conductors. The arrangement will vary with the plan and extent of the work, but it will generally be convenient to have one or two horizontal conductors on the parapet or terreplein, extending from end to end of the battery, attached to vertical conductors connected with the earth. The flag-staff should have a conductor. An iron building is, of itself, a good conductor, but where it is covered with non-conducting substances, such as asphalt and concrete, it is necessary to provide rods or points projecting above the asphalt, and to have a proper connection with each."

Water-mains provide the best earth-connection, if conductors are properly secured to them. In the absence of these, and where there is no drain or well of water near, or where the soil is clay or rocky, the conductors should be surrounded with a quantity of coke to increase the contact, and salt should be applied so as to increase the moisture.

When the conductor is in more than one length of rod or cable, the joint, if with rod, should be soldered, and if cable, spliced carefully.

In applying lightning-conductors to towers, churches, monuments, columns and general ornamental buildings and chimney-shafts and portions of public works, to powder-magazines, etc., the same rules are to be observed. The varying circumstances of each case require to be studied—the extent—the several prominent parts above the roof, preserving the outward appearance of the structure, etc. Generally a more capacious conductor is fixed—the metal work requires to be more carefully joined, and in order to protect the outward amenity of the structure, the conductor may require to be carried down through the center, as in the case of the Albert Memorial, in Hyde Park. In all similar cases the lightning-conductor should form part of the original plan of the structure.

The following, with regard to earth-connections, require to be observed. The lower terminal of the conductor should end in a copper plate, the large surface of which being necessary to facilitate the thorough and more ready diffusion of the electricity It should be led into damp ground—the presence of moisture being a favorable condition—or into a well, water-course or body of water, when practicable. Shingle, sand, or other light, dry soil, or even vegetable soil when dry, not being good earth-connection, the rod should be led through these, and continue till water or a permanently damp soil is reached. The conductor should be led into moist ground by means of a trough extending to at least eighteen inches below the surface, and in which is a considerable length of metal—the War Office recommends as much as thirty feet of metal—or a plate four feet square should be in actual contact with the moist earth—and in the case of very dry sandy soil, the trench should be arranged to suit the circumstances, and may extend from the foot of the conductor to distances of from ten to forty yards, according to the amount of moisture—and when practicable a flow of water should be led from the down pipes of the roof of the building over the ground in the vicinity of the earth-connection, or into the trough just referred to.

With reference to the extent of metal required to be in actual contact with the earth—it must be bo ne in mind, that although the earth, like the air, is a great reservoir of electricity—it is not so good a conductor of such as the metal which leads it from the cloud—and it is often found that when the electricity comes in contact with the earth, it meets with comparatively greater resistance, and unless the conditions are favorable, is with difficulty, dispersed.

*A paper by R. M. Bancroft and F. J. Bancroft, read before the Civil and Mechanical Engineers' Society.

## Is Oil, Gas, or Electricity the Best For Illumination Purposes.

The long series of experiments made during last summer and autumn at the South Foreland to test the respective merits of oil, gas and electricity for lighthouse illumination have been brought to a close, and the reports will now be drafted and published. Pending their appearance—which will necessitate some delay, owing to the voluminous character to the observations—we may mention that the evidence is in favor of the electric light on the whole, because of its far penetrative power. While the rays of oil and gaslights were lost sight of at a distance of eight miles, the electric light could be seen for fourteen miles; and with gas or oil at its maximum power, and visible for ten miles, the electric light could be seen for fourteen and a half miles. Although the arc is very much reduced in fogs it still appears to be visible further than gas or oil. By direct testimony of observers the electric light became visible in dense fogs at a distance of 1,900 to 1,590 feet, whereas gas and oil were only discerned at distances of from 1,500 to 1,260 feet. This is an important point, because it was thought that gas and oil might have the advantage over electricity in dense fogs. There is no doubt that fog does quench the direct rays of the arc light in a remarkable manner; but how much this would diminish its efficacy in a practical sense was not well known hitherto. Probably the white haze surrounding the lamp is detected for a considerable distance, although the arc itself in a fog has lost its brilliance. So long as this haze is seen, mariners will learn to distinguish it as the lighthouse. The heating due to the use of gas was found to be very considerable. With the original 88 jet burners, the temperature rose to 200 degrees F.; but the subsequent use of 108 jet burners brought it to 300 degrees and 320 degrees F. These burners gave an illuminating power of 2,400 candles. The electric arc lamps used gave a light of 12,000 candles each. Four of the gas burners were superposed in a quadriform arrangement, and three arc lights were sometimes used. For the oil lights, the Trinity House six wick burners were employed, each giving a light of 800 candles. We may add that, although the experimental trials are for the present over, the photometric observatory and testing towers will be allowed to remain for further use and testing purposes. This is a sensible decision, since, whatever the result of the trials at present, they can not be regarded as conclusive while the subject of illumination is engaging so much attention.—*Engineering.*

THE Krupp Works are manufacturing for the Italian Government four guns for a shore battery which will be the largest in the world. Each will weigh 120 tons, while a charge of 600 pounds of powder will be required for the firing of the projectile of one ton. The guaranteed range is five miles. The first of these monsters will be tested at Meppen, on the firm's firing grounds, and transported to Italy on specially built cars with sixteen axles, bridges and viaducts having to be strengthened in order to stand the weight.

### The Strength of Ice.

A. Fruehling, of Koenigsberg, in Prussia, has made interesting investigations about the strength of ice. The tensile strength was determined with the common cement testing apparatus, by filling metal forms with water and then exposing them to the frost. Nine test-pieces of ice thus obtained—the smallest cross-section being 0.78 square inches—were torn apart at a temperature of 23° F. The tensile strength varied from 142 to 223 pounds per square inch. Resistance to compression was determined on five test pieces of nearly cubical form, sides being 2.12 by 3 inches, and the height varying from 2 inches to 2.6 inches. These were sawed out of a field of clear ice and loaded at a temperature of 23° F., until small cracks commenced to appear with a cracking noise in the interior of the test piece, which occurred, on an average, at a pressure of 147.9 pounds per square inch, the extremes being 61 and 204.8 pounds. The cracks increased in number and size under heavier pressure, until finally they penetrated the entire body. During the application of the pressure, the height of the test piece constantly decreased, while the bottom area increased, until gradually it was completely squashed, but not broken, as would have been the case with most other materials. About the period when the height of the body commenced to decrease, very detailed and careful observations were made. This occurred, on an average, at a pressure of 305.7 pounds, the maximum being 388.2, and the minimum 216.1 pounds per square inch. The resistance to bending was tried on rectangular pieces of 27 inches to 43.6 inches long, supported on both ends and loaded until they broke. The deflection was measured at the different loads. The first four tests were made at temperatures of 34° to 40° F., and showed a breaking strain of 101 to 134 pounds per square inch, on an average, 122 pounds. During the other five tests the temperature varied from 30° to 28° F.; then the breaking strain was varied from 158 to 400 pounds, being on an average 232 pounds per square inch.

The modulus of elasticity was calculated from the measured deflection; the knowledge of its value is important in calculating the carrying weight of ice fields floating upon water. The values ascertained vary very much, from 61,150 to 179,172 pounds per square inch during dewing, and from 183,438 pounds to 364,032 pounds per square inch during frost.

Inspector Zabel of Breslau gives the following data referring to this question. The data refer to results which Mr. Zabel obtained during 18 years in his official capacity from the ice on the City Canal, which is used for skating by thousands of people. The use of the ice for skating was allowed by the police only when the proper government engineer certified the carrying weight of the ice. It is of greatest importance, that the field of ice is not hollow, that the level of water be kept at uniform height, by the closing off of all outflows. The permission was given, when the ice appeared to be clear, glass-like and uniform, and at least 5½ inches thick. If the ice is not frozen uniformly, but in layers or leaves, the minimum thickness was 8 inches. The following observations have been obtained.

1. A sheet of ice, 5.25 feet long, 2.8 feet wide and 5½ inches thick broke under a central load of 1,710 pounds; the plate rested at both ends on a support, 12 inches long so that the unsupported length was 3.28 feet.

2. An area of 100 square inches of the ice taken from the City Canal, being 5½ inches thick, was loaded and showed large crevices at a load of 6,521 pounds.

3. Continued frost increased the thickness of the ice to 8 inches, and a similar area was loaded with 15,690 pounds, when it showed large crevices.

4. With an area of 9.25 square feet of the same thickness a load of 16,470 produced large crevices. No accidents have occurred when the ice is 5½ inches thick. The lake in the "Schlossgarten" at Koenigsberg is opened to the public only when the ice is 6 inches thick. The ice of the river Pregel, when from 6 inches to 8 inches thick, is used for long stretches by carriages. The thickness of the ice varies with the force of the current, the more or less exposed situation, the flow of subsoil water, etc. The ice is thinner generally at the middle of the river than along the banks, especially during its formation: therefore the measurement of the ice must not be limited to the neighborhood of the banks. At the ferries at Koenigsberg the thickness of the ice is often increased by letting water flow over it in thin layers.—*Centralblatt der Bauverwaltung*, July 18, 1885.

### Private Roadways and Streets in England.

An appeal case has been argued before Mr. Justice Mathew and Mr. Justice A. L. Smith, in which the question was raised whether an open space or approach in front of a block of artisans' dwellings is to be considered a street under the Metropolis Management and Building Acts.

On May 22, 1885, the respondent, Mr. E. Nathan, appeared before Mr. Saunders the police magistrate, to answer a complaint made against him by the Metropolitan Board of Works of having unlawfully formed or laid out a road, passage, or way for building as a street for foot traffic only, without their sanction and contrary to the provisions of sec. 8 of 45 Vict. cap. 14. The buildings erected by the respondent were artisans' dwellings, intended to be let out in separate tenements, opening on an approach not open to the public, comprising in all, when finished, twenty-six such tenements, and capable of accommodating about 250 persons. They were approached from Emmett Street Poplar, through a gateway, not open to the public, 10 feet wide, over which one of the buildings was carried, and were entered from the road, passage, or way alleged to have been unlawfully laid out by the respondent, having each a separate doorway opening thereon. The respondent had given notice to the district surveyor, in compliance with the Metropolitan Building Act, 1855, of his intention to build six artisans' dwellings, but no application had been made by him to the Metropolitan Board of Works, and their sanction had not been obtained to the forming of the way as a street for foot traffic only. This way did not afford any communication with any street other than Emmett Street, and was intended for the sole use of the tenants of the artisans' dwellings to the exclusion of the public. Before the magistrate it was contended for the respondent that no way had been formed or laid out for building by him as a street within the statute, because a road or way had existed prior to the passing of that Act or to the erection of the artisans' dwellings, and that the alleged roadway was in all respects a private entrance for the use of the tenants of the dwellings. The magistrate dismissed the summons, on the ground that the respondent by so building had not formed or laid out a new road or way within the meaning of the Act in question, as there had been a former passage, and the respondent had only put it to a new use. The questions for the Court were (1) whether the respondent had laid out a new road within the meaning of sec. 8 of the Metropolis Management, etc. (Amendment) Act, 1882 (45 Vict. c. 14;) and (2) whether the road or way, being solely intended for the use of the tenants of the artisans' dwellings, and not being open to the public, was a "street" within the meaning of the said Act.

Mr. Justice Mathew, in giving judgment, said that the respondent had pulled down some warehouses which had had an approach to Emmett Street, and had built up artisans' dwellings on the site and somewhat widened the approach to it. The magistrate had held that the approach had not been a street under sec. 8 of 45 Vict. cap 12, and that had been a pure question of fact which he had had to decide. If, instead of erecting artisans' dwellings, the respondent had rebuilt the warehouses, could it have been contended that he laid out a new street? Or again, if he had built flats with a gateway and courtyard, which would be an analogous case to the present, who would be able to say that he had made a new street leading into Emmett Street? There had clearly been evidence justifying the magistrate in saying that the respondent had not "laid out a road or way as a street for foot passengers only." What the respondent had done had been to make a courtyard and not a street. Then, as to the entrance as distinguished from the approach to the dwellings, the widening of the gateway was not a fact which brought it within sec. 8 of the statute in question, but had been an act by which the respondent had only made it more suitable for the purpose for which it had been used prior to the passing of the Act.

Mr. Justice A. L. Smith, in concurring, said that he did not doubt that the late Master of the Rolls had correctly stated the law when he had laid it down that a road none the less became a "new street" because some of the houses were built before it was a street ("Robinson *v.* Barton Local Board," 21 Ch., Div. 621). An entrance might, of course, be so enlarged as to make a new way, but in the present case substantially the old way had been preserved.

Appeal dismissed accordingly, with costs.—London *Architect*.

### Self-Purification of Natural Waters.

F. Emich, the author, has made experiments on the behavior of water on exposure to the air, and on agitation with air. He has experimented also with sterilized water, and on the behavior of waters under the action of ozone, and hydrogen peroxide. The self-purification of water—*i. e.*, the decomposition of their organic and inorganic impurities, may result either from a purely chemical process (oxidation) or from a biological process. It appears that on exposing water to the air, or agitating it together, self-purification ensued only when the water had not been sterilized by boiling, nor had been protected against the entrance of germs. If, on the other hand, a sterilized water had been subsequently exposed to the air, or had been infected by the mixture of ordinary water, it underwent the same changes as water freely exposed to the air. The oxidisability and the proportion of ammonia decreased, whilst nitrous or nitric acid was formed. When, therefore, the development of organisms in the water was made impossible, self-purification was excluded. Hence the inference is justifiable that the two phenomena are casually connected. Direct oxidation by atmospheric oxygen does not occur. Ozone and hydrogen peroxide may possibly co-operate in the natural purifying process, but they certainly play a very subordinate part. The kinds of organisms which effect the purification of waters, converting highly complex compounds into simpler ones, or in short mineralizing them, is very different according to circumstances. A change of species has been observed to one and the same water-course, in the successive stages of its pollution. The self-purification of water in the open channels of rivers is thus brought into connection with the self-purification of soils in which, according to Schlœsing and Müntz nitric acid is formed only by the intervention of organisms. The entire question of self-purification is thus withdrawn from the sphere of pure chemical research.—*Chemical News*.

# Engineering News

AND

## AMERICAN CONTRACT JOURNAL.

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## CLUBBING ARRANGEMENTS.

### 1886.

The "subscription season" for the most popular American Magazines is close at hand, and inquiries as to our proposed clubbing arrangements are being made. We beg leave to announce, therefore, that on and after JANUARY 1, 1886, the subscription price of ENGINEERING NEWS will be $5.00 per year; until that date the price and clubbing rates with other publications will remain as given below.

We are now planning such improvements in ENGINEERING NEWS, and negotiating for special work to be done during the coming year, as will cost double any possible increase of income from subscriptions; the long notice of change which we here give enables nearly, if not all, present subscribers to renew at present rates. We intend eventually to publish a class journal which will acknowledge no superior in the world, and we feel so confident of the support of our present patrons that we have no hesitation in venturing on the greatly increased expense necessary to carry out our programme.

If an English engineering journal, carrying fifty pages of advertisements and twenty four of reading matter sells for $10, why may not an American journal of equal merit sell for at least half as much.

In order to accommodate such of our subscribers as may wish to subscribe for other periodicals, we offer the following terms until January 1, 1886: We will send to any address ENGINEERING NEWS at regular subscription price, $4.00 and the following at the additional prices given:

| | Net. Price. | Reg. Price. |
|---|---|---|
| Atlantic Monthly | $3.25 | $4.00 |
| Century Magazine | 3.55 | 4.00 |
| Harper's Magazine | 3.25 | 4.00 |
| Harper's Weekly | 3.25 | 4.00 |
| Harper's Bazar | 3.25 | 4.00 |
| Harper's Young People (weekly) | 1.65 | 2.00 |
| Popular Science Monthly | 4.25 | 5.00 |
| St. Nicholas Magazine | 2.55 | 3.00 |
| North American Review | 4.10 | 5.00 |
| Cassell's Magazine of Art | 3.00 | 3.50 |
| Cassell's Family Magazine | 1.25 | 1.50 |

The Century Magazine commences its year with the November Number; Harper's Magazine commences with the December Number. Subscribers should renew these Magazines in October and November.

### TO SUBSCRIBERS.

The date of expiration of subscriptions is given on the printed address-label attached to each copy of this paper, and is, we trust, a sufficient notice to all parties proposing to renew for the ensuing year.


THE U. S. Treasury Department has finally made a ruling upon the transmission through the mails of the Transactions of the Institution of Civil Engineers, of London, to the American members of that body.

The charging of custom's duties upon these documents has been referred to before in this journal, and lately a number of the American members petitioned the Secretary of the Treasury asking that this charge be discontinued. Their effort has met with success, and the Department has now decided that this publication is in fact a "periodical" and as such entitled to free entry under the provision for "periodicals," in paragraph 745, Free List Act of March 3, 1883. The duty charge is therefore abolished. The same decision applies to the similar periodical publications of the "Society for Physical Research," also of London, England.

### The Proposed Enlargement of Riker's Island.

Riker's Island lies about eight miles, in a direct line, from the City Hall, in the mouth of Flushing Bay. Travellers by the Sound boats after passing Ward's and Randall's Islands sail between the North and South Brothers and then pass, on their right, the north end of Riker's Island which has an area of 87.5 acres about half of which is less than three feet above tide.

Simon Stevens, Esq., for his client sold this Island to the city for $180,000 or $2057.15 per acre for thewhole area, and last winter the State Legislature made a grant of the submerged land surrounding it out to the 12-foot contour line, with the understanding that it should be filled and become the property of the City Board of Charities and Corrections.

The proposition as communicated to the daily papers is to build cribs on this 12-foot contour line and fill in to three feet above tide with ashes and street dirt.

The length of the boundary line as established by the Legislative grant is 21,036 feet and allowing for a log crib 12-feet wide and 3 feet above water which should be built for 4½ to 5 cents per cubic foot, the cost of cribbing will be from $170,391.60 to $189,324.

The excavation of the blasted rock at Flood Rock offers the city an opportunity to build a rip-rap sea wall at a slightly less cost. Assuming a width on top of 3 feet with the same height above water as the crib, viz.: 3 feet seaward slope of 2 on 1 and landward of 1½ on 1; with 40 per cent. of void spaces the contents per foot run, will be 9.75 or say 10 cubic yards; 210,360 cubic yards in the aggregate. As the amount of rock to be dredged by the government is estimated at over 270,000 cubic yards there will be enough rock from that source, even after the completion of the present contract for 15,000 yards.

The broken rock is now being towed up the Sound and dumped about nine miles from Fort Schuyler, some seventeen and a half miles from Flood rock. The shorter tow to Riker's Island, only about three miles, would save at least $5 per scow load of seventy-five yards, say 7 cents per cubic yard. Unloading this rock on account of its large size will require derricks and mooring anchors or piles, increasing the cost over deep water dumping 75 cents, or deducting the towing say 70 cents, making the cost of the rip-rap wall $147,252. As the stone will probably be broken smaller at a greater depth, it is not probable the cost of unloading will be increased, though the contractor for dredging might look for a larger profit. The ability, however, to build cribs at a maximum cost of $9 per foot run, will restrain the desire for large profits, and as the boats that bring the street cleanings cannot safely lie at the rip-rap, it will be necessary to have a portion of the island cribbed. It seems safe to assume about a mean between the highest and lowest prices, and to estimate the sea wall at $170,000.

The quantity of filling as computed in the coast survey office for Mr. Stevens, is as follows:

| | Area in Acres. | Area less the 3 feet above high water. | Cubic yards to fill up to high water. | Total Yards to fill 3 feet above high water. |
|---|---|---|---|---|
| Riker's Island | 87.5 | 43.2 | | 104,540 |
| Shoal West | 79 | | 1,440,400 | 1,818,000 |
| Shoal East | 315 | | 7,069,500 | 8,635,600 |
| Total | 481.5 | | 8,509,900 | 10,558,140 |

The amount of street dirt, ashes and garbage collected annually, according to the Superintendent at Street Cleaning, is about 1,200,000 loads of 1.5 cubic yards each, which pressure will compact to 1.1 cubic yards, allowing the completion of the work in eight years, if it all went to the Island, but both Superintendent Greene and Deputy-Commissioner Seabold, of the street cleaning department, think the State Board of Health would prohibit unloading there during the months of June, July, August and September, on account of the stench, citing the case of Hart's Island, where work was stopped on that account.

On the other hand, from 200,000 to 300,000 cubic yards of cellar and building dirt are removed yearly from the city by scows. When no dock filling is in progress, this earth and rock will be delivered at the island if the city will unload it, so that with the growth of the city ten years may be taken as a fair limit of time.

The present arrangements for disposing of street refuse are as follows: Both deck and pocket dumping scows are used, the first carrying about 500 cubic yards, and drawing 7½ feet, are owned by the city; the latter, carrying about 600 yards, are hired at the rate of $17.50 per day, the owners furnishing men to dump the loads. The account with the first is as follows:

| | |
|---|---|
| Four days rent @ $6 | 24 |
| Towing | 25 |
| Nineteen days labor, unloading @ $2 | 38 |
| | $87 |

With the dump scows:

| | |
|---|---|
| Two days rent @ $17.50 per day | 35 |
| Towing | 30 |
| | $65 |

The difference in time of scows is due to the fact that the dump scows leaving their berths in the evening, go to sea without regard to tide, and return to their berths in time for the mornings work, while the deck scows lie over in Gravesend Bay.

The yearly expense of this present mode of disposal is according to Superintendent Greene, who gives the preceding estimate and whose figures are adopted for the cost of towing to Riker's Island, about $175,000 per annum. The distance towed averages about twenty-three miles, and about 60 per cent. of the dirt goes out in dump scows.

The average distance to Riker's Island is twelve miles, and the cost of towing from the East river is estimated at $10 per scow and from the Hudson $18, as in one river or the other adverse tides will be met. Assuming equal quantities for each front, the cost will be:

| | |
|---|---|
| Four days rent of 500 yards scow @ $6 | 24 |
| Towing | 14 |
| | 38 |

or, 7.6 cents per cubic yard. If breaks are left in the sea wall, the deck scows can be taken inside and unloaded for 5 cents per cubic yard, but as the material will have to be distributed, it will be safe to estimate the whole amount at 15 cents per cubic yard, this will make the cost for the 10,558,140 cubic yards

$2,387,240; as an offset to this the annual cost of the present method should be considered, if the work could be prosecuted continuously this for the eight years would amount to $1,400,000. If on account of interference by the State Board of Health the time is lengthened to eleven or more years, the offset will amount to decidedly less, as an organization must be kept up that for four months will take the dirt to sea, and as the dump scows cannot be used at Rikers Island, it must be done by deck scows costing say 17½ cents against 11 by dump scows.

It is unfortunate that the trouble about the stench will occur in the summer, for though the incentives to surreptitious dumping in the bay will not be as great then as in winter, the nuisance of fouled beaches at Coney Island and other resorts will be the greater.

If, however, it should still remain impossible to enforce the law requiring the separation of garbage and ashes (Boston, with 390,000 inhabitants, sells its garbage for over $36,000), it may be practicable to disinfect the material. A good solution for this purpose would be ½ pound of bichloride of mercury at 50 cents per pound, and one gallon of dead oil at 65 cents, to 50 gallons of water. This, allowing two gallons per cubic yard, with labor, would cost $20 per scow load of 500 yards, or $17,600 for each term of the four hot months.

We thus have, supposing the dumping to be continuous throughout the year, the following estimate:

| | |
|---|---|
| Sea wall | $170,000 |
| Towing and unloading | 2,387,240 |
| Disinfecting, four months for eight years | 140,800 |
| Add 10 per cent. for superintendence, etc | 269,844 |
| | 2,967,844 |
| Less 175,000 per year for ten years | 1,750,000 |
| | 1,217,844 |
| Adding cost of present island | 180,000 |
| | 1,397,844 |

which equals $2,903.10 per acre for the proposed island, without counting interest on the expenditure during construction.

### Street Cleaning in New York.

Street Commissioner Coleman has submitted to the Gibbs Committee a rejoinder denying the charge made by Commissioner of Accounts Shearman, that street cleaning in 1884 under Mr. Coleman cost more than it did in 1879 under the Police Department.

Mr. Coleman says that 63,778 more loads of sweepings and 37,213 more loads of snow and ice were removed in 1884 than in 1879; and secondly that the carts of 1884 held one-fifth more than those of 1879. He also says that the streets were cleaned much oftener by him and that the increase in cost from $150,000 to $309,000 is attributable to the fact that 35,000 miles of streets were swept in 1884, (instead of 14,968) and that the sweepers' wages were $2.00 as against $1.60 in 1879. Carting costs more from the increase in wages, and the refuse must be taken further to sea than in 1879, and more is taken out.

Mr. Coleman very properly concludes that the work of street cleaning cannot be estimated on the number of miles cleaned and "loads" hauled; these figures only give an appropriate idea of the thoroughness of the work. It is much better to figure upon the number of times a street is cleaned within a definite period, and the manner in which it is cleaned, and the regularity with which the refuse is removed.

The present Commissioner certainly has the majority of the citizens with him when his work is compared with that of the Police Department; he has not confined his attention to the main thoroughfares to the utter neglect of the alleys and byways as was formerly the rule.

While much yet remains to be accomplished in the perfect cleaning of our highways, a great deal of the present want of thoroughness must be charged to the condition of our city paving itself rather than to the Commissioner. The paving is wretched in a great part of the city, and the ruts and holes with which it is filled are in a great measure due to the very frequent tearing up to which this paving is subjected. The percentage of increased cost of street cleaning chargeable to irregularity of surface is a quantity difficult to figure but doubtless large; and until a comparatively smooth and regular surface is secured and maintained, this work can never be reduced to its minimum in cost. Under present conditions we do not see just how the breaking of the paving, for additions or repairs to the intricate system of pipes now beneath the surface, can be prevented. But we do believe that more concerted action on the part of the departments having these pipes, sewers and street paving in charge would greatly reduce the number of breaks and widen the intervals between. The City of Boston, under its new charter, requires that if a street is to be paved or repaired, the superintendent of streets must confer with the water, gas and sewer departments and give them an opportunity to do any proposed work thereon before the paving is laid or repaired. If the departments named neglect this opportunity they are debarred from touching that street for a period of six months, except only in case of dire necessity and by special permission. This is a decided improvement on ancient methods.

Where this underground system in New York is so intricate and varied as to require very considerable attention, subways would seem to be the only solution to the problem; and though they would be undoubtedly very costly, it is a question whether their construction would not be more then offset in expense by the saving in surface work and the greater comfort to the travelling public.

### The Baltic & North Sea Canal.

Late advices show that the German Bundesrath has unanimously approved the bill for the construction of the projected canal from the North Sea & Elbe to the Baltic.

This canal as now located is from Glückstadt, about 30 miles down the Elbe from Hamburg, to Kiel, on the bay of the same name. The estimated cost is $39,000,000 including fortifications and is calculated for the largest ships. The project has been under consideration for some 30 years and about five years ago Mr. Dahlström made a location and estimate for a canal starting from Brunnsbüttel, about 15 miles nearer the mouth of the Elbe than Glückstadt, ending also at Kiel; this was to have 24½ feet on mitre sills and its estimated cost was $17,750,000. In 1879, 36,670 vessels passed between Denmark and Norway (3,000 or 4,000 less than pass the St. Clair Flats) and it was reckoned the canal would save 30 hours for steamers and 4 days for sailing vessels; there was also the further advantage that the canal would allow the speedy and safe concentration of the German navy in either the North Sea or Baltic.

The project has been held in abeyance until Germany had increased its fleet of war vessels. The German navy being now in a satisfactory state and the Bundesrath being fortunate in the total absence of statesmen whose aim is to prevent or retard the cheapening of their country's methods of distribution or increasing its means of offensive or defensive warfare, this canal is apparently to be pushed to an early completion.

There is now a navigable route by the Eider to Rendsburg and thence by canal with 9½ feet on mitre sills to Holtenau, a port about three miles north of Kiel. This system of navigation, like the two systems between Liverpool and Manchester, seems about to be superceeded by a larger and more commodious canal; whether the disused canals will like ours that were too small for economical transportation, be filled up and used for railroads, remains to be seen.

### Coal in Illinois.

From the "Statistics of Coal in Illinois fo 1885," a supplementary report of the State Bureau of Labor Statistics, we make the following extracts:—

Over 25,000 citizens of Illinois are dependent for wages upon the successful operation of the coal mines of that State, and nearly $10,000,000 of capital are employed. For the year ending July 1, 1885, 9,791,874 tons of coal were mined from 786 mines, with 25,446 employes of all kinds. The average value per ton at the mines was $1.17; the average price paid per ton for mining was $0.72½; 140,382 kegs of powder of 25 pounds each were used; 39 men were killed and 176 men injured so as to lose time; the number of tons mined for each life lost were 251,073, and there were 652 employes for each life lost.

The prevailing method of mining is to undercut and blast the coal down with powder; there being only forty-one mines where powder is not used in the face. As a deduction from the tables given we have the fact that an average of one keg of powder is used for every 50 tons of coal made, and 12½ kegs used by each man for the year. When viewed in detail, however, there is a wide range in these figures; coal mined per keg of powder ranges from 17.8 to 205.8 tons, and powder used per man, from 2.3 to 31 kegs; the average from the great coal counties is about 100 tons per keg and from 6 to 8 kegs per man.

The casualties reported are exceptionally low; in the preceding year there were 46 men killed, and in 1883, the year of the Braidwood disaster, there were 134 lives lost and 231 men hurt. In the 3 years, 219 men were killed and 604 injured, or an average of 138,821 tons of coal mined for each life lost. Sixty-four per cent. of all accidents for 1885 were from rock falling from the roof; 7 men were killed by falling down the shafts; 2 men by gas; 2 men by cages; 2 by pit cars; 3 by timbers, as against 20 by falling of roof. The year 1884 showed sixty-seven per cent. of fatal accidents as due

to the latter cause, and the year 1883, fifty-four per cent.

In the act of July 1, 1885, of the Illinois Legislature, providing for the health and safety of persons employed in coal mines, the amount of ventilation required is as follows: "The amount of air in circulation is to be in no case less than one hundred cubic feet for each man, and six hundred cubic feet for each animal, per minute, measured at the foot of the downcast, and the same to be increased at the discretion of the inspector, according to the character and extent of the workings, and the amount of powder used in blasting."

### Testing Water for Organic Life by the Gelatine Method.

Col. Sir Francis Bolton, C. E., the official Water Examiner of London, England, in his report for October, 1885, gives the results of a biological examination of the various waters supplied to the metropolis during the month of October; the test was made by Percy F. Frankland, M. D.

The tests were made by the gelatine process and, as regards the relative freedom from organic life, the results ranged from two organisms per cubic centimetre for the New River and West Middlesex supplies, to fifty-three organisms per cubic centimetre for that from East London. The following table shows these results as taken both from the Thames river at the intakes, in the mains and in two deep wells of the Kent Co.:

| Name of Supply. | Date and Place of Collection. | Temperature in Centigrade Degrees. | | Number of Micro-organisms contained in 1 cubic centimetre of water. | |
|---|---|---|---|---|---|
| | | Sept. | Oct. | Sept. | Oct. |
| THAMES. | | | | | |
| Thames water (unfiltered) | The Ferry, Hampton, Oct 26th | — | 10°.0 | 1,644 | 714 |
| Chelsea | Cab Rank, Horse Guards, Whitehall, Oct. 26th | 13°.9 | 10°.5 | 13 | 34 |
| West Middlesex | Cab Rank, Portland Road, Oct. 26th | 14°.3 | 10°.5 | 2 | 2 |
| Southwark | Cab Rank, Bricklayers' Arms, Old Kent Road, Oct. 26. | 12°.6 | 10°.3 | 18 | 24 |
| Grand Junction | Cab Rank, Uxbridge Road, Marble Arch, Oct 26th | 13°.4 | 9°.5 | 43 | 40 |
| Lambeth | Cab Rank, St. George's Road, Southwark, Oct. 26th | 14°.3 | 10°.1 | 103 | 26 |
| LEA. | | | | | |
| New River | Cab Rank, Tottenham Court Road, Oct 26th | 13°.5 | 9°.9 | 3 | 2 |
| East London | Fire Brigade Station, Commercial Road, E., Oct. 26th. | 13°.2 | 9°.9 | 29 | 53 |
| KENT. | Well at Deptford, Oct. 29th | — | 12°.0 | — | 6 |
| | Greenwich Police Station, Blackheath Road, Oct. 29th | 14°.2 | 12°.3 | 14 | 18 |

### Propeller Sluicing.

One of the late papers of the Institution of Civil Engineers, by Mr. Harry Hawgood, describes the deepening of some bars on the Columbia river, by means of a moored propeller, the screw generating sufficient current to deepen the water 6 and 10 feet.

The propeller was moored to three anchors, one directly ahead and one on each quarter leading astern. The boat used was a screw-collier, 2124 tons register, 330 feet long, 40 feet beam and 16 feet draft, cylinders 40 and 70 inches diameter by 5 feet 6 inches stroke; the boiler pressure was 80 pounds. The screw was 17 feet in diameter with 20 feet pitch, which made 54 revolutions per minute for its maximum.

In one instance a channel 1,200 feet long, 200 wide and 6 deep, was sluiced out in three days; another channel 1,600 feet long, 150 wide and average cut of 6 feet was sluiced out in 48 hours working time; the next year the same cut required eight days. The steamer was loaded so that stern just cleared the bottom, and by means of the hawsers leading to the moorings aft of the quarters the stern was slewed around till the full width of channel was sluiced out, when the steamer was fleeted back about 25 feet. The current at the stern was 12 to 14 miles per hour, and ¼ mile aft 3 to 5 miles, a portion of the sand being swept over the bar and some piled up on the side cemented gravel and stones of the size of cocoa nuts being washed out and driven down the stream without difficulty.

The author thinks, in some cases, a bank could be brought to the surface of the water on one side of the cut which might be useful in river-training; also that a transatlantic steamer might open a channel 40 feet deep, the steamer used on the Columbia having excavated to a depth of 7 feet below her propeller.

The first instance in which this method is known to have been used was about 1873, when a propeller was shut up in a harbor on the east side of Lake Michigan by a storm that drove the sand through the pile and slab piers, then built in that locality, so that there was only about two feet of water in the channel. Government assistance promising to be too slow, the captain led a hawser to the end of each pier, and loading his stern, sluiced himself out, though at first it was discouraging work as the sand filled the space between the piers, at times, decidedly above the water line.

### Rensselaer Polytechnic Institute.

We take the following from the Troy *Times*, of December 17th and 18th, believing it will interest many of the graduates:

The trustees of the Rensselaer Polytechnic Institute held an interesting meeting on yesterday afternoon. W. P. Mason was given a full professorship in chemistry, and his salary was increased $200 a year. Trustee J. C. Platt, Jr., of Waterford, N. Y., presented a report of a committee recommending the consolidation of the office of president and director in one person instead of two as now. He argued that it would be of great benefit to the Institute. He said that if the proper man could be obtained to fill the position, it would attract large numbers to the school. The resolution called forth a heated discussion; President Forsyth said he had been willing and ready to resign the office of president for a long time, but he did not propose to be voted out, neither was he in favor of having Director Greene used in that manner. Action on the resolution was indefinitely postponed by a vote of 7 to 6, President Forsyth casting the deciding vote. All of the Trustees present at the meeting who are graduates of the Institute favored the consolidation; several graduate trustees were not present.

### PERSONAL.

MR. GEORGE MOTZ, a civil engineer, and son of the late county surveyor, has been elected county surveyor for Madison County, Alabama.

RALPH MODJESKA, son of the actress, who is in the engineers department of the C. B. & Q. R. R., has come east to be married to his cousin Felicia Benda, recently arrived from Poland

CALVIN PRATT, ex-chief engineer of the South Park and Utah Pacific Railroads, who is wanted for forgery in New York, Denver and San Francisco, to the amount of $20,000, has been arrested in Honolulu and will be returned to San Francisco for trial.

MR. J. W. BUSHNELL, chief engineer of the Florida Railway and Navigation Company, has been appointed master of roadway of that system, with his office at Fernandina.

ISAAC BROKAW, well known in Rahway, N. J., as a log and pile contractor, was instantly killed by a Long Branch express train lately, at Spa Springs, a station near Rahway. He lived at Linden, N. J., and was married.

AN exchange says:—It is learned on excellent authority that the $200,000 bequeathed to Vanderbilt University by the late William H. Vanderbilt will probably be used in the erection of a fire-proof library building and the purchase of books for the same.

MR. HORACE J. HALE, engineer of the W., St. L. & P. railroad at Danville, has been married in Covington, Ind., to Miss Luella Shields, of Attica. The wedding occurred at the home of the groom's father, Mr. John Hale, one of the oldest engineers in the employ of the Wabash management, he having commenced running on this road in 1855. Mr. Hale is also a nephew of United States Senator Hale.

FRANK UNRUH, a civil engineer, late of Germantown, Pa., was murdered near Trinidad, Colorado, on December 14th, near his home; robbery seems to have been the incentive. MR. UNRUH was about thirty years old, and went west about ten years ago; he was in the employ of the Government at the time of his death.

C. D. BROWN, an engineer residing at Cheyenne, Wyoming Territory, recently entered the office of John A. Benson, a land surveyor, in San Francisco. An altercation occurred, and Brown, drawing a revolver, fired three shots at Benson, inflicting dangerous wounds. He then shot himself three times and cut his throat with a paper knife, dying almost instantly. It is believed that the difficulty grew out of a dispute about money affairs.

CHARLES H. FISHER, engineer-in-chief of the New York Central Railroad, whose mental malady was reported two weeks ago, has become violent since he learned of the death of William H. Vanderbilt. A specialist on disease of the brain has been consulted by the family. He said that Mr. Fisher's case was hopeless, and before his final breaking down he would have a period of frenzy in which he would be dangerous. The doctor advised that he be placed under proper restraint. During the past two days his actions at his home in Lansingburg have led to the belief that he would do bodily injury to his friends. He became possessed of pistols and locked himself in his room, fearing that something ill was about to befall him; he was taken to the Poughkeepsie Asylum.

MR. CORNELIUS C. F. BENT has been appointed Superintendent of the O. and M., and assumed the duties of the position on Dec. 15. Mr. Bent is comparatively a young man, born in Boston, Mass., July, 1849. He is now but 36 years of age. He entered the railroad service when 18 years of age in the engineering corps. From 1869 to 1870, he was Assistant Engineer of the Lake Superior & Mississippi road, now the St. Paul and Duluth. From 1870 to 1873 he was chief engineer of the Lancaster railroad, of Massachusetts; 1875 to 1876, assistant superintendent of the Pennsylvania Railroad; 1876 to 1879, supervisor of the same road. In 1879 he was made assistant engineer of the Pittsburg, Cincinnati and St. Louis road which position he held until 1881, when he was made superintendent of the same road, which position he held for a year, when he went with the New York, and New England as superintendent, which position he resigned in April, 1884, to accept the superintendency of the Louisville, New Albany and Chicago road, with headquarters at Lafayette, and which

place he resigns to accept service with the Ohio and Mississippi.—Louisville *Courier Journal.*

PROF. JOHN C. DRAPER died on December 20th at his residence in New York from pneumonia. PROF. DRAPER was born in Prince Edward County, Va., March 31, 1835, and was the oldest son of Prof. John William Draper. He was educated at the University of the City of New York; he graduated from the medical department of that institution in 1857. In 1862 he served six months as Surgeon of U. S. Volunteers, and in 1863 took the chair of physiology and natural history in the College of the City of New York, which he had held ever since. He wrote many scientific articles and edited Scribner's Year Book of Science for 1872, and Dr. Draper's Year Book of Nature and Science for 1873; he edited the department under this head in Scribner's Monthly up to 1876.

### Engineers' Club of Philadelphia.

RECORD OF BUSINESS MEETING, DECEMBER 5th, 1885.

President J. J. de Kinder, in the chair; 35 members, and 1 visitor present.

The following candidates were elected members of the club. *Active*: Messrs. E. B. Wingate, Henry C. Zacharias, Louis G. Laureau, Fred. W. Gordon, W. M. Patton, Victor O. Strobel, A. Saunders Morris, A. B. Broomell, Howard Wood, Wm. F. Mencke, and Louis N. Lukens. *Associate*: Messrs. Frank K. Esherick and L. Frank Gordon.

Mr. John T. Boyd, for Mr. Washington Jones, presented to the club some specimens of artificial fuel made in Belgium, and sent to him from there by Mr. E. F. Loiseau, who is now abroad experimenting on its manufacture.

The specimens are on exhibition at the house of the club, and consist of cylinders having a hole along their axes, cubes, perforated square blocks, and two sizes of egg-shaped masses, corresponding about to our "egg" and "stove" sizes of anthracite coal.

This fuel is made of bituminous coal dust, coal tar, pitch and clay, mixed in suitable proportions and compressed into the shapes named.

Some few years ago, Mr. Loiseau was making the smaller of the egg-shaped sizes in this city, and then the material was passed through rollers having recesses which formed the eggs.

A peculiarity of these eggs was that they retained their shape until all the combustible material was entirely consumed, and then fell apart in a fine powder. The specimens shown bore labels stating the quantities of the several sizes made per day.

Mr. C. W. Buchholz presented a paper of more than ordinary interest upon "Engineering; its Achievements and its Reward." A view was taken—broad, historical and practical—of what the man of technical science has done for his fellow-men; of how essential he is to human progress; and of how his results, and more especially, he himself, are acknowledged and appreciated when his share is allotted him by those who pocket the millions which are the direct proceeds of the creations of his intellect.

HOWARD MURPHY,
*Secretary and Treasurer.*

### Michigan Engineering Society.

LANSING, MICH., Dec. 9, 1885.

The Executive Committee held a meeting in Ann Arbor, October 23rd, and transacted the following business: Prof. J. B. Davis was elected a delegate to represent the Society at a meeting to be held in Cleveland, O., composed of delegates of all the Engineering Societies of the country, to consider a method of changing the present status of civil engineers, respecting government civil works. A programme for the next convention was blocked out in a general way as follows:

TUESDAY, Jan. 26, 2 P. M.:—Reports of President and various permanent committees; appointment of new committees and organization of sections. 7:30 P. M.—Address of the President, "Technical Education."

WEDNESDAY, 9 A. M.—Meeting of standing committee to pass on papers to be read. 9:30 A. M.—Meeting of the society in three separate sections as follows: Section A, Surveying; Section B. Civil Engineering; Section C, Mechanical Engineering. 2 P. M.—Excursion to various points of interest at University. 7:30 P. M.—Address before the whole society.

THURSDAY, 9 A. M.—Continuation of excursion. 2 P. M.—Meeting of societies in three separate sections. 7 P. M.—Meeting of standing committees.—7:30 P. M. Address before the whole society—general session.

The Executive Committee promise the members an excellent programme and especially desire those who expect to present papers, to forward an abstract as soon as possible to the Secretary.

The complete fulfillment of the above programme requires the election of a vice-president or chairman of each section, and the appointment of a standing committee who shall exercise a censorship over papers to be read or published, and who shall pass on candidates for admission. It has been suggested that such a committee should be composed of the Executive Committee and the Vice-presidents of the sections. The Executive Committee also recommended the adoption of the letter ballot for the election of members, as possessing the advantages as follows over any other method: time at the annual convention is saved, each member of the society is allowed to vote on a candidate for admission, and the fitness of a candidate can better be ascertained.

R. C. CARPENTER, *Secretary.*

*Executive Committee*, Prof. J. B. Davis, President. Prof. M. E. Cooley, W. S. Russel, C. E. Hollister.

### Rhode Island Institute of Architects.

The meetings of the Rhode Island Chapter American Institute of Architects are at present held on the second Monday evening of each month at the Narragansett Hotel, Providence, R. I. The following list has been arranged for discussion at future meetings:

No. 1. Woods—kinds, treatment, use, etc. Subject for sketches to be announced at meeting.

No. 2. Consideration of different forms of classic renaissance architecture in the different countries. Subject for sketches "Renaissance Mantelpiece."

No. 3. Foundations—party walls and laws in relation thereto. Subject for sketches, "Small Railroad Station" (plans).

No. 4. Color and decoration. Subject for sketches, "A Frieze."

No. 5. Treatment of grounds, fencing, drainage, grading, etc. Subject for sketches "Gateway to Fine Grounds."

No. 6. Office practice and the training of students. Subject for sketches, "Doorway to an Architect's Office."

No. 7. Building materials. Subject for sketches, "A Small Summer-house Commanding Fine View."

### A Quarterly Review for Engineers.

The Techniker Verband, an association of German civil engineers, architects and chemists, of Philadelphia, Pa., has made arrangements with the Social Science Publishing Company, of New York, for the publication of a quarterly review, called "Annals of Technology," in which the lectures delivered at the meetings and other matters of interest to the profession are to be published. The society will have a Christmas celebration on December 26th at Reisser's restaurant.

### The Quantity of Air Required in the Ventilation of Buildings.*

BY E. F. HARTFORD, MEMBER OF THE WESTERN SOCIETY OF ENGINEERS.

The following is submitted as addendum to an interesting paper on "Ventilation of Stables," recently presented by Mr. A. W. Wright, Member of this Society.

The authorities consulted have been Pettenkofer, De Chaumont, Parkes and others. From these we learn that a man *at rest* exhales for each pound of his weight 0.00424 cubic feet of $CO_2$ per hour. Under the same conditions he exhales 0.1189 cubic feet of air.

If $n$ = number of miles a man may walk in one hour (or its equivalent in other work), then

$CO_2$ per pound of weight per hour
$$= 0.00424 + 0.00211\ n, \qquad (1)$$
and air exhaled per pound of weight per hour
$$= 0.1189 + 0.0591\ n. \qquad (2)$$

In the paper by Mr. Wright it is stated, on the authority of the Boston *Journal of Chemistry*, that "a horse or cow is said to have six times the breathing capacity of a man." This is the allowance commonly made in the ventilation of mines in Europe, where the animals used are about six times the weight of the average miner. If this allowance be a correct one, and experience indicates that it is, we may assume that the larger domestic animals have the same breathing capacity as man per pound of weight.

Now let

$V$ = cubic feet of air required in a given time.

$T$ = time in hours.

$W$ = weight of man or animal in pounds.

$x$ = allowable excess of $CO_2$ above that in normal atmosphere.

Then
$$V = \frac{(0.00424 + 0.00211\ n)\ W\ T}{x}. \qquad (3)$$

The best authorities have agreed that 6 parts of $CO_2$ in 1,000 parts of air should be the maximum limit with good ventilation. The normal condition is about 4 parts of $CO_2$ in 10,000 parts of atmosphere, making for all practical purposes

$x = 0.0002$.

The average weight of a car horse may be taken at 1,100 pounds = W.

If it be assumed that in a stable a horse does work equivalent to $n = \frac{1}{4}$, the formula for stable ventilation becomes

$V = 26235\ T$, or $\qquad (5)$

$V = 437.25$ cubic feet of air per minute.

If the horse be regarded as at rest, $n = 0$ and $V = 388.7$ cubic feet of air per minute.

Formula (3) is of general applicability.

I am aware that my results look large, but I believe they are no larger than good ventilation requires, if the ventilating apparatus alone is relied upon to furnish the fresh air. That unknown quantity which may pass through cracks, etc., is not considered.

Of course, the results change with the choice of a different value of $x$. Some authorities say the limit of $CO_2$ in good respirable air may be 10 parts in 10.000 parts, making $x = 0.0006$, and $V = 7773$ cubic feet of air per hour as necessary for one horse (about 26 cubic feet per minute more than Wr. Wright gives). But if the experiments of Drs. Angus Smith, Parkes, Pettenkofer and De Chaumont have any value, this is much too low for *good* ventilation.

*From the Journal of the Association of Engineering Societies, read August 4th 1885.

### Improvement of Waterways.

The English statistician Mulhall credits the United States with nearly one-fourth of the total industries of the world, including agriculture, manufactures, commerce and transportation. Our agricultural products are about two-tenths of the world's total, and our manufactures are about three-tenths. And yet, excepting a small part, the stupendous annual out-put of commodities is consumed on our own soil. Our commerce is chiefly domestic commerce. The food products and raw materials of the West go East, and the manufactured products of the East come West. The North carries on great exchange with the South. The whole nation is interested in the cheapening of transportation between the two sections. The improvement of the Mississippi and its tributaries, and the opening of a water passage from the Mississippi to the great lakes, would benefit the East as much as the West. Viewed in a detached way, particular Western river improvements seem only of local desirability; but when considered as one great system covering the upper half of the Mississippi Valley, and bringing down its products for the benefit of the whole nation, these watercourses appear, as in fact they are, a less local and sectional interest than the Atlantic Ocean. The improvement of ocean harbors is work of a less national character than the improvement of the natural highways in the heart of he country.—Minneapolis *Tribune*.

## LITERATURE.

*Transactions of the American Society of Civil Engineers.* November, 1885.

CONTENTS:—Report of the Committee on a Uniform System for Tests of Cement. Behavior of Cement—Mortars under various contingencies of use. With a brief discussion of certain tests, etc. By F. Collingwood. The Cantilever Bridge at Niagara Falls. By Charles C. Schneider. The discussion of this last-named paper will follow in the next number of the Transactions.

*The Cost of Manufactures and the Administration of Workshops, public and private.* By CAPTAIN HENRY METCALFE, Ordinance Department. U. S. A. John Wiley & Sons, Publishers, New York, 1885. Size, 9-inches by 5¾-inches., pp. 322. Price, $5.00.

The author of this work aptly calls his subject the science of administration, and he has endeavored to reduce this science to formulas, so plain that all who have an interest in knowing can read them. The ultimate purpose of the scheme is to reduce labor to a minimum and yet immensely increase the scope of information by minutely recording the service performed and the conditions relating to material in all the stages of its manufacture, received, expended, and remaining on hand. The system itself lies in the proper form and use of order tickets, time cards, material tickets, and other time and labor saving devices of like nature, especially the use of numbers or symbols for purposes otherwise requiring much writing, and the substitution of hand punches for signatures in many cases. The system is fully described and illustrated, and it has stood the test of practice in three of the U. S. Arsenals.

*Proceedings of the Michigan Engineering Society at its Sixth Annual Convention*, held at Lansing, Feb. 17, 18, 19 and 20, 1885. Price 40 cents, apply to Prof. R. C. Carpenter, Secretary, Lansing, Mich., or Prof. C. E. Greene, Ann Arbor, Mich.

This is a handsomely printed document of 120 pages. Besides the record of the Convention, list of members, address of President, and reports of committees, the papers published are as follows: Questions in Practice, by I. H. Leavenworth; Estimating the Amount and Value of Standing Pine, by S. S. Hastings; The Separate System of Sewerage, by G. S. Pierson; Pure Water and Pure Air, etc., by W. R. Coats; Deviation of Ships' Compasses, by H. C. Pearsons; Suggestions to Beginners in Land Surveying, by D. Skeels; Random Remarks on Maintenance of Way, by E. Treadwell; Location of the Western Division, Can. Pac. R. R., by Frank P. Davis; Legal Position of a Surveyor in Michigan, by Hon. L. S. Montague; Legal Requirements for Village Plats, by G. E. Steele.

ENGINEERING NEWS, Three Months, One Dollar and Fifty Cents.

## CORRESPONDENCE.

### The Cleveland Convention.

ST. LOUIS, Dec. 18, 1885.

ED. ENGINEERING NEWS: Publicity was given through your columns, in issue of Nov. 28th, to the refusal of a Committee of Engineers' Club of St. Louis, to send a representative to the meeting at Cleveland, Dec. 3, 4 and 5. By your heading some were led to think this was the act of the club; it was not. The committee was alone responsible, and its action does not commit the club in any way.

This act of the Committee (and by the way, the pioneer committee appointed by an engineer society since 1880, to consider the status of civil engineers on Government work) toward a convention professedly called to devise means of bettering the condition of civil engineers so employed, occasioned some surprise and perhaps some questioning why it was done. The committee simply concluded that no good result was likely to come from the meeting. Has the result justified that opinion?

From letters received it appears that some think that the meeting avoided the narrow personal or class issue we repudiated, and have suggested that the St. Louis Club ought now to endorse the action of the convention. Whether such endorsement should or should not be given, is a matter of interest to the whole profession, and a discussion in professional press is appropriate, as helpful to other societies than St. Louis in determining this point.

The writer, speaking for himself alone, maintains that endorsement should not be given to the utterances of the Cleveland convention as they are set forth in the statement and suggestion adopted, for the reason that the statements are indefensible, and that the course of action suggested is not appropriate.

Exactly what the report adopted by the convention should be called, is hard to say. Certain propositions were stated, which, it may be supposed, embodied the reasons present in the mind of the convention, why Congress ought to grant the request suggested, or at least reasons why such a request might be made. Apparently an address or memorial is contemplated, and these propositions may be taken as instructions to the Executive Board in preparing the address, a sort of preliminary platform.

The first proposition is "The foremost nations of the old world have organized systems of internal improvements. The United States at present has no such system. The marvelous development of this great country demands some adequate organization of such a system." System may mean scheme of improvement or method of conducting such works, the latter is doubtless the sense to be taken. These nations have kings and other trimmings. We have none. Do we want them? But it is not true that the United States has no system of internal improvement. It has a scheme, and it has a method. The first incomplete, the second imperfect, and admittedly so. The problem is to perfect it. How? This is the broad gauge question I contend for.

The next proposition to be noticed is "The main reason for the success of such works in foreign countries is due to the fact that they are executed under a civil administration, etc." What proof is there that such works are more successful abroad than here? Yet this is an implied assumption. I, for one, deny it, so far as river engineering is concerned, or canal works, such as Louisville, Des Moines, Sault Ste. Marie or submarine work, as Hallet's Point or Flood Rock, etc. But, if the assumption were true, by what process can it be shown, that the better success is due to the fact of civil administration. Might it not be greater ability, and higher technical training, of executives? Or some other of a dozen supposable reasons?

Next it is said, "The distinguishing feature of these organizations is the employment of the best available talent, of men especially fitted by education, training and experience, to design and execute such works." Singularly, this is just what the inconsiderate admirers of the Engineer Corps U. S. Army claim is secured by an education at West and Willett's Point and in the work of that corps. Surely, if a close bureau like the Corps des Ponts et Chaussées is the model, we have a very fair imitation of it now. Military titles superadded is the main difference. No close bureau, be the model foreign or home, will secure the "best available talent."

Then follows, "Under our present methods (observe that the first proposition asserted that we have none), the government cannot possibly secure such trained skill. The reason is that no emoluments or reputation, commensurate with the service rendered, or equal to what can be obtained on other civil works, are attained on the Public Works of our Government."

"These facts deter men of experience from entering the service of the Government, and also those who have gained experience therein, from remaining in its employ."

To many, these thoughts, and even language, may seem familiar and suggestive of the echoes of a bitter controversy. An inheritance of this nature, even if it be but an echo, is not desirable. But aside from this, is it possible to discuss these propositions without introducing personalities? If not, away with them.

The recommendation is, "Recognizing that a comprehensive system of Public Works is necessary, we respectfully suggest that Congress should be asked to establish a Civil Bureau of Public Works; the basis of organization of this bureau to be made the subject of study, and report, by a board oppointed by the President of the United States; said board to consist of seven members, three military engineers, three civil engineers, and one member of the legal profession."

To the proposition that Congress establish a Civil Bureau of Public Works no exception can be taken, on the contrary, this is what should be done. But the suggestion, goes further and asks for a board to study out an organization. In this board suggestion, it is first really assumed that this is a question in which engineers as a class are the chief parties concerned, for they have six-sevenths of the board. Next it is assumed, that engineers are divided into two factions of opposing interests, so each faction is given an equal representation, and an umpire furnished.

If the matter of introducing class features had been carefully studied, they could not have been more thoroughly embodied than in this suggestion. Not only class, but class within class. Virtually Congress is asked to say "This matter is not worth our attention, you fellows go and divide it between yourselves, then come back and report." The practical and sufficient criticism is, that Congress will not do any such thing, and ought not. If there be no more involved than outs *vs.* ins, or a division of government pap, the matter is unworthy of consideration.

In framing the statement it was an error to go across the Atlantic, for reasons to justify an American act, when much better reasons can be found at home. As for foreign organizations, he is a poor engineer who would follow a precedent, when the conditions of work are totally unlike, as they are in the United States compared with the "foremost nations of the old world."

As an example of the reasons which might have been brought forward, and which would avoid the suspicion of class interests or antagonisms, I offer the following substitute for the Cleveland platform.

The public works undertaken, and that must be undertaken by the General Government of the United States, have reached a stage of developement not contemplated when the present executive system came into existence. When such public works were first proposed their constitutionality was questioned, and to meet that question they were begun, and prosecuted largely as measures connected with the public defence. Even as late as 1867 the military use of waterways, and other transportation facilities, was the leading argument urged; the commercial value of such improvements was, in form at least, assigned a second place. Execution, under the direction of the War Department through an Army bureau, of public works whose ostensible object was military, was then thought appropriate, indeed was a necessary consequence of the theory

All this is now changed. Commercial and economical reasons control, military are scarcely thought of. The wants and conveniences for the exchanges of peace have replaced the requirements of war. With this change the scope, number and importance of such improvements have vastly increased, they have passed beyond, or outgrown the provisions made for their execution and design. They have also passed out of the special domain of military engineering into that of civil engineering.

Such being the case, Congress should now make deliberate choice between two alternatives.

1. If a quasi military organization is to be adhered to, then let the members of the Engineer Corps U. S. Army be increased, until that corps is strong enough to discharge all its duties without the necessity of employing civilians, either as experts, or as subordinates to do the hard and disagreeable work, or:

2. Recognizing the essentially civil character of public works, organize a bureau for their design and execution on a civil basis. If the country desires to utilize the services of army officers, for reasons of economy, or to use public works as a school of experience for such officers, let them be detached or detailed, not to occupy high and easy places, but to serve as others serve.

We, believing that the interests of the public service demand that the second alternative should be chosen, respectfully request Congress to establish a Civil Bureau of Public Works.

ROBERT E. MCMATH.

### Tests of Cement.

New York, Dec. 11, 1885.

EDITOR ENGINEERING NEWS:—The annual report of Chemist E. J. De Smedt to the Engineering Department of Washington, D. C., as published in the ENGINEERING NEWS of December 6th, is filled with valuable suggestions to manufacturers of hydraulic cements generally.

In our letter published in the same issue, we suggested that the true methods of arriving at the value of cements was by analysis (you made us say in the 10th line "cements" instead of chemists), and we are gratified to note that Prof. De Smedt has taken that position.

In his concluding remarks the Professor states that his labors have resulted in shedding some light on the subject of cements that will prove valuable, not only to the manufacturer but also to the consumer. We trust he will continue to shed light on a subject that is constantly growing in importance in this country. We know of no better way to advance the interest of manufacturers generally than to ask for information on the subject through the medium of your valuable journal, hoping thereby to obtain the views of those chemists who have made cements a study, also the views of progressive manufacturers and thus gain both theoretical and practical knowledge of the subject. To that end we as a manufacturer would be glad to receive further information touching several points raised by Prof. De Smedt.

He takes the position that the character of a cement is known by its proportion of ingredients, governed of course by the proper degree of heat and length of time in calcination, and proves his conclusions by mechanical tests of tensile strain. We regret that the Professor did not state whether or not his tests were made by submitting the briquettes to exposure of one hour in air and twenty-three hours in water in the one day test, and if so whether the one hour in air was counted from the time the briquettes were taken from the moulds, or included the time in the mould; nor does he state that the tests were made immediately upon taking the briquettes from the water; as it is well known that variations upon these points have much to do with results, *it is presumable that all were treated alike.* It is noticeable that his results with the Portlands were exceptionally good, and with the common or natural cements exceptionally bad, and we cannot avoid the conclusion that the Professor builded up his theory of accounting for the superiority of the Portlands on a foundation that is not fairly proven.

He states that he has found by analysis and *comparative tests* that the best results were obtained where the alumina does not exceed one-third or one-fourth the total amount of alumina and silica. We know cements that contain as much alumina as silica, that will withstand a tensile strain of 100 pounds to the square-inch after one hour in air, and twenty-three in water. We do not quote this to prove that such cement is of the best quality, but to show that chemical theory does not always agree with mechanical tests or tensile strain. The Professor also states that a cement containing a large proportion of magnesia is slow in setting, from which we are to conclude from his standpoint, that such cement would necessarily make a poor showing in a one day test by tensile strain—yet we know of cements containing over 28 per cent. of magnesia, that when exposed one hour in air, and twenty-three in water, will sustain upwards of 100 pounds per square inch tensile strain. We may add that this cement does not at all conform to the formula as laid down by the Professor as being necessary to the obtainment of a good cement, and we are inclined to believe that his conclusions were drawn with a limited knowledge of the many excellent brands of natural American cements produced in various parts of the country; a knowledge that did not extend beyond the few very ordinary brands that seek a market in and about Washington.

It is stated in the report that an addition of soda and potash is beneficial to a cement; we wish to inquire what is the chemical process by which these benefits are obtained? Is it not true that, although they may assist in reducing the silica to a gelatinous consistency, thereby aiding in formation of silicates, they are still deleterious substances that work harm in the end through tendency to dissolve, exposed in masonry? It is desirable to get a clear idea concerning "aluminate of lime;" in ignorance the writer had supposed alumina, lime, and magnesia to be bases capable of conversion into silicates, through the agency of silicic acid during process of calcination, but it seems alumina can be ranked as an acid and as such be combined with lime producing "aluminate of lime." We would be glad to have this explained.

Can there be any such thing as sulphuric acid in a cement? The table of analysis leads one to infer that it exists in a free state. If present in any form, must it not be a sulphate, and if so, is it certain that any small quantity will be harmful, would one, two, or even ten per cent. be harmful further than being valueless as a mortar-making material, the same as oxide of iron or silica in excess? We have been led into making these inquiries purely in the interests of manufacturers We can understand that whatever Prof. De Smet may have to say, must necessarily carry great weight with engineers in charge of public works, who will naturally form opinions in conformity to the views as expressed by the Professor relative to proportions of ingredients, and while we do not pretend to say that those views are not correct when applied to the brands of Portland that were subjected to his special investigation, we are not prepared to admit that the same rules will govern when applied to many excellent brands of natural American cements, some of the *best* of which contain large proportions of magnesia. We say "best" as proven by their high tensile strain value and their proven durability. MANUFACTURER.

## Chemical Test of Cements.

WASHINGTON, D. C., DEC. 16, 1885.

EDITOR ENGINEERING NEWS:—In answer to your favor of the 11th inst., and the long query of a "manufacturer". I will herewith endeavor to give you the desired information.

*First Query.*—Process of testing hydraulic cement. The method of testing hydraulic cements adopted by this office was given in my annual report of 1884 to the Engineer Department, D. C., which is as follows: The cement neat or mixed with sand, is, in a given proportion, mixed with water in sufficient quantity to make a stiff paste. It is formed into O=O shaped briquettes, the cross-sectional area of the central portion being one square inch. As soon as thus formed, it is removed from the mould and exposed to the air until set; that is until it can be handled without danger of cracking; it is then immersed in a water bath, and the briquettes are at different intervals taken directly from the water, and, without being dried, are broken in a Fairbanks' machine.

There are numerous reasons why the briquettes should be broken while wet, of which I will state a few that will be sufficient to show their importance.

1st. The hydraulic cements set by the hydrations of silicates and aluminates in the presence of water, therefore the entire absence of water stops the setting of the cement by hydration.

2nd. The cement may contain uncombined clayey inert substances, which, when moistened, compacted and then dried, may have a great cohesion, thus showing a great tensile strength, which tensile strength is in part lost when afterwards brought in contact with water. In such case the original test by breaking the briquette dry is a deceptive one, differing materially in its results from that produced by breaking it wet.

3rd. Hydraulic cements frequently contain an excess of free lime, and, if so, they will crack when immersed in water. The cracking is, however, often not perceptible for several days after the immersion. In such a state the cement ought to be rejected.

4th. Hydraulic cement is intended to be used in underground foundations, sewers, water-conduits, etc., where it remains moist or wet. For that reason alone it seems important that hydraulic cement should be tested as to its tensile strength while wet, and as much as possible under the same conditions as when finally used. Therefore, where the cement is to be used in submarine works, the briquettes, on account of the difference in the composition of sea water, ought to be immersed in that kind of water taken from the locality where it is to be used, in order to ascertain the chemical effects of the compounds of this water on the cement, which may be detrimental to certain brands and not to others.

*Second Query.*—Portland cements, as compared with ordinary light-burned cements. The Portland cements are unquestionably far superior to the light-burned cements. This is admitted, not only in Washington, D. C., but all over the world where a study has been made of improving hydraulic cements.

*Third Query.*—As to the quality of the light burned hydraulic cements used in Washington. I consider the quality of the light-burned hydraulic cements used for the public works in the District of Columbia, as being fairly good qualities of that class of cements, and for information I will say that no bad quality is accepted, but that all good qualities are accepted on these works, without considering the name or locality where made.

*Fourth Query.*—Quantity of alumina in cement. I have found by experience that an excess of alumina is detrimental, as such cements are often quick setting and might show high tensile strength in a few days, but often crumble and crack after six months, or a years' duration under water. I have had Portland cements containing a small percentage of alumina giving good results. The question I am now investigating is if alumina is absolutely necessary in order to produce a superior cement, such as the Portland quality.

*Fifth Query.*—Magnesia. As to the percentage of magnesia in hydraulic cement I have to refer to what I have said in my last annual report, which is based on investigations in my own laboratory work, analyses, etc., from samples from all localities wherever I can obtain them, and also from all authorities I can lay my hands on. If my contradictor has a peculiar cement which gives results as stated by him I would receive with thanks a sample of it from him of which I will make an analysis and endeavor to find out the reason for the deviation from the general results obtained, my only aim being to help, when possible, the manufacturer in the improvement of hydraulic cements.

*Sixth Query.*—Alkali, soda or potash. In Europe in manufacturing Portland cement, when by analysis no potash or soda is found, about one per cent. is added, which improves the quality.

*Seventh Query.*—Alumina in some conditions acting as an aid. To this query my contradictor could have found himself an answer if he had only consulted a good text-book on chemistry. But supposing I am speaking to a manufacturer and not to a chemist, I will quote from "Le Dictionnaire de chimie pure et appliqué de H. Wurtz," first part, page 171.

"Lime forms with alumina several insoluble compounds, and one of these aluminates $AL^2 O^3$ Cao is formed during the calcination of hydraulic limes and cements."

*Eighth Query.*—Sulphuric acid. Sulphur found by analysis, which might be as sulphuric acid combined with one of the basis, or as a sulphide, is by chemists generally calculated as sulphuric acid. For more information some other analyses must be consulted besides mine. Some will be found in Gen. Gilmore's book on cements. As to its being detrimental in all hydraulic cements, I have to repeat what I said in my annual report that more than one per cent. is detrimental, and the freer cement is of sulphur, the better it is. This is based on actual facts and experiments, too long to enumerate here.

This communication being already too long, I will conclude by stating that Portland cement contains less inert matter than the light burned, ordinary cements. Portland cement averages about ten per cent. of inert matter and light burned ordinary cements about thirty per cent. of inert matter. I will still add that, everything being equal in fineness and proper calcination, the quality of a cement is in the ratio of the quantity of active setting matter, such as bibasic silicates of lime, magnesia and the alkalies, and aluminate of lime, and that the chemist can judge the quality of hydraulic cements by analysis and calculation of the formation of the active compounds, viz: 2 Cao $S i O^2$ + Cao $AL^2 O^3$.

Now I will quote from my honored contradictor's previous letter to the ENGINEERING NEWS and agree with him when he says "I would venture the assertion that there is but one proper way to test any cement and that is chemical analysis" etc., but this being the case what great advantages would result by employing chemists at all the important hydraulic cement manufactories? This would not only "demonstrate faulty methods, imperfect combinations and lack of advancement in the art of manufacture," as stated by the manufacturer's letter, but it would put the manufacturers of this country, where the raw materials exist in abundance, in a condition to improve their hydraulic cements and to compete with the world in quality and price by the exportation of American Portland cement.

Let us try it! I remain, with great respect,
Yours truly,
S. J. DE SMEDT. Chemist.

## To Determine a True Meridian—Errata.

In the article on the above subject, in ENGINEERING NEWS, December 12, 1885, page 375, please make the following corrections:—In the 6th line below Fig. 1, for "the line will move *east* about" etc., read "the line will move *west*" etc.; in first line under Fig. 2, for "will move *west*" read "will move *east*."

I. O. BAKER.

## Brick-Encased Stand-Pipes.

NASHVILLE, TENN., Dec. 17th, 1885.

EDITOR ENGINEERING NEWS: A water tower built in this city in August, 1878 has some of the characteristics described by your correspondent at Lampasas, Texas. He can be furnished the details of construction if he desires. The general features are as follows:

A stand-pipe of boiler iron, 9 feet diameter, 114 feet high, was encased with brick in the ordinary way of constructing tall chimneys with hollow walls. The inside wall circular, fitting the outside of boiler-iron stand-pipe; the outside wall rectangular, 12 feet × 12 feet at base, 13 inches thick, tapering to 5 feet 2 inches × 5 feet 2 inches at the top. The inside circular wall and outside wall run together about 90 feet from the base.

The position is one of great exposure to wind, being on the top of a bluff 160 feet high. No indication of injury from oscillation can be discovered.

Very truly,
W. F. FOSTER,
former City Engineer.

## Canadian News.

Special Correspondence ENGINEERING NEWS.

OTTAWA, December 19, 1885.

The main item of "Engineering and Contracting" news in Canada, this week, is the issuing by the Dominion Government of advertisements calling for tenders for the works necessary to increase the depth of water in the Welland Canal to 14 feet. This is to be attained on the summit level, namely that of Lake Erie, by deepening the canal where necessary, the structures having already been put down to the requisite depth, and on the reaches below the Lake Erie level by raising the embankments, lock walls, etc. When these works are completed, vessels which can pass

through locks 270 × 45 × 14 feet can go from Lake Erie to Lake Ontario.

An effort is being made just now, which no doubt will prove successful, to raise the necessary funds to build a branch railway from Lachute to St. Andrews and Carillon, a distance of some eight miles, the object being, besides accommodating the present population of those towns, to develope the resources of the water power created by the "Carillon Dam," which is immense, the ordinary flow of the Ottawa river, during low water, being about 30,000 cubic feet per second.

I will send you copies of the specifications of the Welland Canal Works as soon as they are issued.

The Brockville and Westport R. R. seems to be an assured fact. The townships have already voted $6000 per mile in aid of the scheme, and the latest advices on the subject are that Mr. E. M. Cole, of Brockville, has secured capital in England sufficient to warrant proceeding with the construction of the line. Mr. Cole returned by the "Baltic."

Mr. Thomas Swinyard, at present looking into the affairs of the Quebec Central Railway, has just returned from a trip over the road, and is preparing his report which will shortly be presented to the bond holders in England. The company is seeking parliamentary powers for the reorganizing and extension of its system through the Chaudiere valley to connect with the International or Short Line Railway to St. John, N. B., and Halifax.

The Electric Lights have been turned on in Smith's Falls, Ont. The adjoining town of Perth has been awakened from its torpidity and wants electricity also. It needs it badly. B.

## Illinois and Indiana News.

Special Correspondence ENGINEERING NEWS.

CHAMPAIGN, ILLS., Dec. 19, 1885.

Mattoon, Ills., has just completed water works at a cost of $75,000; water obtained from eight driven wells fifty feet deep. The city pays an annual rental for seventy-two hydrants; there are 109 private consumers.

Galesburg, Ills., is to be lighted by the Sperry electric light. The company start off with sixty-seven subscribers, and expect soon to put in an incandescent lamp plant, and provide lights of from 10 to 100 candle power for dwellings. A rival company has just been organized, which will introduce the Thomson-Houston light.

The stockholders of the Crawfordsville, Ind., gas company have authorized the purchase of an electric light plant, and will send a committee to inspect the various systems as used in the large cities.

A company with a capital of $4,000 has been organized to bore for natural gas at Liberty, Ind.

Coal was found in the Fairbury, Ills., shaft, just sunk, at 130 feet.

The first coal mined in America was taken at Ottawa Ills., in 1669.

The Hoosiers claim that their new State House, now nearing completion, will be "at once the best building of its kind in the country in material and work, in beauty and durability, and that it shall be the cheapest ever built for the money, not because it cost less, but because nothing in it is poor or second-rate, and nothing done that is not as well as it could be done. The walls have been growing for five years, and now the full weight is upon the foundations, but not a crack has appeared in any part of the walls or foundation, a most complete proof of the solidity of the structure and the honesty of the work."

A company is prospecting for natural gas near Jeffersonville, Ind.

The City Council of Farmer City, Ills. have issued $4,000 in bonds, the money to be used in some needed public improvements, one of which is the building of an iron bridge across Salt Creek, which runs through the corporate limits of the city. The bonds bear seven per cent. interest, and are payable in four years from next April.

The County clerk and two supervisors of Douglass County, Ills., are a committee to arrange for building a fire and burglar proof vault for the county records, at Tuscola.

The business quarter of Chicago will on New Year's eve be lighted by electricity from the tower of the Board of Trade. The lamp will be of forty thousand candle-power. The cost is to be about $4,000 per annum, which has been subscribed by citizens directly interested. B.

## WATER

PROPOSALS will be received by the Water Commissioners, Abington, Mass., until January 15, 1886, for laying about 22 miles of water-pipe.

THE works at Harrisville, R. I., connected with the water supply, are nearly completed. The walls of the pumping station are almost ready for the roof. When this is done and a few hundred feet of pipe are laid, the works will be in running order.

CHICAGO, ILLS., is attempting to disinfect its sewers by burning sulphur and throwing copperas into them A single cleansing of this kind costs $1,000. The ventilated manholes every 300 feet in the principal streets give some trouble.

THE National Tube-Works of McKeesport, Pa., have contracted to furnish the city of Charleston, the new capital of West Virginia, with the entire pipeage and tubing necessary for its new water-works system. There will be between thirty and forty cars of material.

SOME one placed a piece of Limburger cheese in the lining of a Santa Cruz merchant's hat, and the merchant has been loudly proclaiming that the city needs a sewer system right away, as the smell of sewer-gas is something awful.—Santa Cruz (Cal.) *Sentinel*.

THE ARTESIAN WELL.—Work on the artesian well at Seaconnet, R. I., does not progress as favorably as heretofore. After getting down about twenty-five feet, the drill struck a seam in the rock, which threatens to stop further progress. It will be a serious loss to the contractor if he is obliged to abandon the work already done and commence anew.

CHEAP WATER WORKS.—Galesburg, Ill., has recently made a novel and cheap provision against fire. A couple of small streams in the suburbs are dammed at various places by setting a wide board edgewise from bank to bank; above this primitive dam, a barrel is sunk in such a position that its top is always under water. In case of a fire, the hose is dropped into the nearest barrel and the engine set to work. This scheme will, of course, fail in cold weather.

THE new city water-works at Mattoon, Ill., have been tested and found to work satisfactorily, meeting the requirements of the contract by throwing six streams of water on Broadway to the height of seventy-five feet. The works have been built and are owned by the Pittsburg Water and Gas-works Construction Company, the city paying $5,000 a year for water for the fire department.

THE Mount Vernon, N. Y., Board of Trustees, at their recent meeting, passed a resolution urging Assemblyman-elect N. A. Lawlor to secure the passage of a bill by the next Legislature providing for a general system of sewerage for that village. They find that the introduction of water into the place necessitates the building of sewers to render the water supply of any practical use.

ADRIAN, Mich., December 14th.—The Adrian Water-works Company has decided to discontinue the suit brought against the city for non-acceptance of the works and non-payment of rent. The city demurred to the declaration on the ground that a water supply was not alleged, and the Circuit Judge sustained the demurr. It is presumed the case will go to the Supreme Court upon that point.

CANASTOTA, N. Y., Dec. 15th.—The pipes of the water-works were completed on the south side of the canal and water was let in the pipes last Friday, though the dam to the reservoir was not closed, so that the only force was that obtained in the fall of 233 feet from the reservoir to the village. Contractors Sherwood and McDonough, with the Board of Trustees, Engineer E. D. Smalley and the Fire Department, under Chief Engineer William H. Patten, made a test to day. The test was entirely satisfactory to the most critical of the spectators.

DRAINAGE IN ILLINOIS.—A ditch, southwest of the Mason and Tazwell county ditch, known as the Garden District Ditch, drains some lands which have been cultivated, but the raising of a crop thereon was so uncertain that the proprietors thought it wise to expend $20,000 to thoroughly drain 10,000 acres. The work is nearly completed, and has been a great success. In the Long Branch district, six miles south of Havana, $14,000 has been spent in draining 9,000 acres, which has not proven an entire success, owing wholly to the ditches being too small.

Another ditch in Sherman township, Mason county, drains 10,000 acres, and cost $18 000, the benefits of which have already more than paid the cost, although the county ditch which forms the outlet is much too small. The Central Drainage district, same county, has been organized to drain what is known as Goose Lake, comprises about 10,000 acres, and will do work estimated to cost $62,000. The Fairview district, comprising about 1,000 acres, which have not been a complete success because of the ditch being too small, now proposes to lay 6,000 feet of sewer pipe deep enough to serve as an outlet. Some of the land in this district has already paid $15 per acre, and is willing to pay more for the sewer pipe line.

THE Hyde Park, Ill. Board of Trustees met Dec. 14 An ordinance creating a special drainage district under the new Drainage act was engrossed. The district comprises 758 acres lying between Sixtieth and Sixty-seventh streets and Stoney Island avenue and Charles and South Park avenues. The main features of the scheme consist of pumping-works located at Sixty-third street and at Stoney Island avenue, a sewer in Sixty-third street, between the eastern and western limits of the district, with laterals, forty manholes, and thirty-two catch-basins. The sewer varies in size from sixty to twenty-four inches, being largest at the eastern end. The pumping-works are to be of a capacity of 50 000 gallons per twenty-four hours. The mouth of the sewer is to be at Fifty-sixth street, twelve blocks from the water-works. The cost of carrying out the scheme will be about $100,000, to be raised by special assessment. The cost of maintenance will be raised by special assessment each year upon the district.

THE DELAWARE CHANNEL.—At a late meeting of the Franklin Institute, Philadelphia, Pa., the paper of the evening was presented by Professor Edward F. Moody. It was on "The Channel of the Delaware River at Philadelphia." After tracing the river's early course when it flowed east of Camden, he described the growth of the Smith's Island bar, which was begun by small bars formed below sunken vessels. "Of all that interests Camden to-day," he said, "I know of nothing more important than this bar. In 1850 it only showed at low water. Now it can only be crossed within two or three hours of high water. It is dangerous to dig it away, for it would undoubtedly reform elsewhere. To narrow the channel and wash it out would run its 5,000,000 cubic yards of material into the bay and ruin it for navigation. The tendency of ships now is to go down the river. Our steamers are so long that the channel above is too narrow for them to turn in. The Government plan of the Fisher's Point Dyke is the only one that can do what is necessary. The injunction laid on it having been dissolved, it is probable that it will be finished by next summer."

## NEWS OF THE WEEK.

### Miscellaneous.

**A Substantial New Dock.**—The Long Island Railroad Company has had a new dock built for the accommodation of its business in Greenport. It is substantially framed of Southern pine timber, being 40 feet wide and extending 170 feet over Peconic Bay.

**A Great Gun Factory.**—In accordance with the recommendations of the gun foundry board, Senator Cameron has introduced a bill in the United States Senate directing the Secretary of War to build at the Watervliet arsenal at West Troy an army gun factory, at a cost not to exceed $1,000,000 for the fabrication of the heaviest guns adapted to modern warfare, the manufacture of gun carriages and ordnance equipments for each service.

**Fast Steamboats.**—Efforts have recently been made in Europe to invent small steam craft capable of being propelled at almost express railway train speed. A small vessel for service in the Adriatic is now being constructed by a Prague engineer, the speed of which will, it is alleged, equal that of a fast railway train. This result is expected from an improved screw and a novel method of construction. Great interest is manifested in the experiment.

**A New Oil Pipe Line.**—The Tidewater Oil Company people have secured the right of way for an oil pipe from the wells in Pennsylvania, through New Jersey, to Constable Hook, adjoining the great Standard works. The distance is a trifle over 300 miles. The pipes which are six inches in diameter, are to be three feet below the surface. Through the State of Pennsylvania four large pumps are stationed to force the oil. The capacity of the pipes is 10,000 barrels daily. The cost of laying will be about $6,000 per mile. About one mile can be laid a day.

One hundred and seventy miles of pipe is already laid in Pennsylvania. The work of laying the pipe in New Jersey will be begun in May. The Jersey terminus of the pipe will be a little north of the Rahway river, where it will cross to Staten Island, and thence on and across the Kill von Kull to the Hook. When the pipes are complete the withdrawal of oil trains on the Philadelphia and Reading Railroad will follow. The cost of this enterprise will be $2,000,000.—Philadelphia *Press*.

**Floating Out of the First Large Girders of the Tay Bridge.** The first set of the large girders for the centre spans of the new Tay Bridge were floated out from the south side of the river about three weeks ago, and successfully placed in position on piers 40 and 41. The two large pontoons recently built were used for taking out the girders, and they were found to answer admirably. Four tugs were in attendance, and the difficult undertaking was accomplished, in little more than an hour, under the superintendence of Mr. Arrol and Mr. Inglis. The girders are 245 feet long, 29 feet deep, and the flooring is 28½ feet wide. The total weight of the girders is 550 tons. Another set of girders was expected to be floated out to-day, and then the work of under-building will be briskly carried forward, the girders being raised by means of hydraulic jacks as the piers are built to the necessary height. Rapid progress is being made in sinking the few remaining piers, and the superstructure at both ends is now finished for a considerable distance out into the river.

## Railroads, Bridges and Canals.

**The Smith Bridge Company**, Toledo, Ohio, has taken a contract to build a new iron bridge with a draw-span 174 feet long at Alpena, Mich.

**East Saginaw Bridge Company**, East Saginaw, Mich.; capital stock, $30,000; term of existence, thirty years; has been organized to construct a bridge on Genesee street across the Saginaw River.

**The Welland Canal.**—OTTAWA, Dec. 10.—Tenders for the work of enlarging the Welland Canal are called for to-day. The estimated cost of the whole work is about $1,250,000.

**Cascade Div., N. P. R. R.**—San Francisco telegrams announce that the contract for building the tunnel on the Cascade division of the Northern Pacific has been let to Ferguson, a St. Paul contractor. This report is premature. The contract has not been let nor will it be until after January 1. Bids will be received until that time.

**Brooklyn Bridge.**—In his report of the operations of the bridge, for the year ending Dec. 2, made to the Mayor, President Howell says that the receipts for tolls were as follows: Promenade, $23,011.34; carriageways, $58,468.32; railroad, $537,435.09, a total of $618,914.75. The total receipts show an increase over those of last year of $84,921.75. Since the opening of the bridge, on May 25, 1883, 38,418,366 passengers have made use of it.

**A New Railway Bridge.**—Gen. Manager J. B. Gardiner, of the New York, Providence and Boston Railway, has commenced operations at Apponaug, R. I., looking to the replacement of the old wooden drawbridge, with one of iron. The bridge crosses a small arm of Cowesett Bay, and it is the longest one on the main line of the road, being 200 feet from one abutment to the other.

**Railway Development in Norway and Sweden.**—The construction of new railways in Sweden and Norway, has within the last few years been energetically proceeded with. One or two smaller lines have been opened for traffic during the present year, and several new lines are more or less advanced. The line between Ofoten-Lulea will be pushed with all speed as soon as the winter is over, when 3,000 men will at once begin work.—*The Ironmonger.*

**The Florida Canals.**—JACKSONVILLE, Fla., Dec. 9.—John L. Hill, of Philadelphia, has returned from a three weeks trip through the region of South Florida. The canals have already reclaimed many hundred thousand acres of nice tillable bottom lands, suitable for cultivation of sugar and all semi-tropical fruits, and upwards of 350 miles of inland navigation have been opened up, affording inland water communication nearly across the peninsula of Florida.

**Failure of Railway Bridges.**—ST. JOHN, N. B., Dec. 10.—While a freight train on the New Brunswick Railway was passing over a bridge across the north branch of the Oromocto river to-day, the bridge gave way, and the engine fell into the river. The night express from Boston soon afterwards passed over the south branch bridge and attempted to back down to Frederickton Junction. It was then discovered that the supports of the south branch bridge had also given way, and the train had a very narrow escape from a dreadful disaster. Both bridges had been under repairs.

**A Pope who Thought of a Suez Canal.**—Some manuscripts have lately been found in the Vatican archives of Sextus V.'s time (1585), showing that that Pope had the idea of cutting a canal across the Suez Isthmus It is a fact that Father Eschinardi, a Jesuit of that time, the author of a treatise on architecture, gave a lecture on the possibility of cutting the Isthmus, and foresaw that the difficulty would arise not from the waters, but from the accumulation of the sands. This was, in fact, the only difficulty foreseen and experienced by De Lesseps. Father Eschinardi's works may have been known to De Lesseps.

**New Cable Company.**—NEW YORK, Dec. 14.—Edward T. Stokes, Cassius H. Reed, Dwight Tounshend, Edward Lauterbach, O. A. Cochran and Patriek C. Alpin, are incorporators of the Southern Telegraph and Cable Company, which filed a certificate of incorporation to-day. Its lines are to run from this city through the United States and Canada, to any point on the coast of Ireland, to Penzance, London, Brussels and Paris. The capital stock of the company is $100,000, divided in 100 shares of $1,000 each, with the right to increase it.

**Steel Sleepers in Belgium.**—The administration of the Belgian State Railways is about to introduce metallic sleepers upon a rather considerable scale. The first lot will comprise 36,080 iron or rolled steel sleepers on the Post system with the transversal profile adopted by the Netherlands Railway Company. This lot will represent a weight of 2,625 tons. The second lot will comprise 35,000 iron or steel sleepers, on the Post system (or 2,625 tons), with the Braet transversal profile. The third lot will comprise 5,000 iron and steel sleepers on the Bernard system. This lot will represent a weight of 525 tons. The cost of metallic sleepers being necessarily higher in the first instance, they must establish their superiority by lasting longer and by securing a reduction of maintenance expenses.—*The Ironmonger.*

**U. S. Senate Bills for Public Work.**—Dec. 8th.—Bills were introduced as follows:

By Mr. Cullom.—To provide for the construction of the Michigan & Mississippi River Canal, and to cheapen transportation. [The bill is identical with Mr. Cullom's bill of last session, known as the Hennepin canal bill, save that it reduces the amount of the appropriation made available by its passage from $1,300,000 to $500,000.]

Bills for construction of public works were introduced as follows:

By Mr. Cullom.—A bridge over the Mississippi river at Alton, Ill.

By Mr. Vest.—Two bridges across the Mississippi River at St. Louis, Mo. Also bridges across the Missouri river between its mouth and the mouth of the Dakota, and across the Mississippi river between St. Paul and Natchez, and across the Illinois river, between its mouth and the sound.

Dec. 9th.—Bill was introduced as follows:

By Mr. Cullom.—To authorize the Dillingham Bay Railroad & Navigation Company to build bridges in Washington Territory.

**Hoboken's Elevated Railroad** is expected to be opened to travel about January 1st, next. The road is one mile and one-eighth long, extending from Hoboken Ferry to Palisade avenue, on Jersey City Heights. John H. Bonn is President, Alfred Debevoise, Superintendent, and John J. Endres, Chief Engineer. Mr. Endres invented the grip to be used. The cable is picked up by the conductor on the front platform, and can be dropped at will. The grip on the Brooklyn Bridge cable can be taken up only at either end. Hoboken is happy over that fact. There are two grips on the Hoboken cars, both fastened to the trucks. They are of cast iron, and are three feet long. The Brooklyn Bridge cars have only one grip, which is suspended from the body of the car, which when heavily loaded causes a depression of the grip, while the grip on the Hoboken cars retains its place, no matter how the cars are loaded.

The grade of the new cable road is five feet to a hundred. There are vertical and horizontal pulleys to facilitate the passage of the cars around the only curve in the road. The run from the ferry to Jersey City Heights was made in six minutes. The switching in each depot is done on the cars, and not by means of locomotives or switching trucks, as on the bridge. Hoboken was pleased with that fact, too. The cars are of the same size as those used on the bridge. The diameter of the numerous vertical pulleys over which the cable runs is twenty-four inches. The pulleys on the bridge are fourteen inches in diameter. An engine of 500 horse power moves the cable. There is a reserve engine of similar power to be used in an emergency. The cable passes over two drums, the wheels of which are twelve feet in diameter. There are also two reserve drums. There are four large boilers of 100 horse power each, two to be used only in case of necessity.

## Contracting.

**Charleston's Wharves.**—The wharves that are built in Charleston, S. C., to replace those destroyed by last summer's cyclone, rest upon zinc-covered piles.

**Dallas, Tex.**—The opening of bids on 18,000 ties for the Texas Trunk Railroad took place at 3 P. M., December, 7th. There were nine bids in all, and the contract was awarded to Harry Bros. of Dallas.

**Chicago Paving.**—A contract has been awarded or paving North avenue, Chicago, from Milwaukee avenue to Western avenue, with cedar blocks at $1.03 a square yard. The work will not be commenced until the sewer is put in next spring.

**Minneapolis Sewers.**—Minneapolis, Minn., reports nearly 8¼ miles of sewers built in 1885 at a cost of $182,697.59. The sewer tunnel, to be 7,000 feet long, has 1,200 feet completed, at about $33 per foot. The work contemplated for 1886 includes 38,088 feet of sewers to be built, not including the tunnel; the estimated cost is $135,561.

**Canadian Contracts.**—QUEBEC, Dec. 11.—The Court of Appeals has rendered a decision maintaining the validity of an award by arbitration which allowed Mr. McGreevy, the contractor, only $147,000 on his $1,000,000 claim against the Quebec Government in connection with the building of the North Shore Railway.

**Chicago Bridges.**—The following estimates have been submitted by the Public Works Committee, Chicago. On the cost of a bridge at Canal street: Bridge, $50,000; opening a new street from the terminus of that street to the river and from the northern terminus of Hanover street to the river, $111,750; total, $161,750. For a bridge at Wright street extended, 1,650 feet of viaduct and 350 feet of approaches, $392,750; opening of streets, $348,000; total cost of bridge, viaduct, and lands, $641,351. A bridge at Market street was estimated at $98,000 besides the land damages. The cost of a swing bridge at Carpenter street was estimated at $50,000 in addition to the extension of Carpenter street and the opening of a new street. The communication was ordered, referred and published.

**The Southern Bridge Company** was incorporated in Birmingham, Ala., November 27th, with a capital stock of $25,000 and the privilege of increasing it to $100,000. E. W. Linn and W. J. Cameron are the incorporators.

**Street Work, Jersey City, N. J.**, asks proposals until January 11, for the improvement of Pearsall Avenue. Quantities, "5,000 cubic yards earth and 5 cubic yards rock excavation;" with gravel, curbing and flagging. Also for improving Morris St.

**Proposition for Gas and Electric Lighting.**—Propositions are invited and will be received by W. S. Reese, Mayor, for the purpose of lighting the City of Montgomery, Ala., with gas and electricity. Population of city, 25,000.

**A Verdict Against Chicago.**—JOLIET, ILL., Dec. 11.—The jury in the case of P. J. Sexton against Cook County, a suit for $200,000 damages caused by the construction of the Chicago Court House, brought in a verdict this morning, finding for Sexton the sum of $134,954.88.

**New Tube Works.**—It is stated that the largest tube-works in the country will soon be built near Pittsburg, Pa. The capital stock is given at $500,000. The incorporators are George F. McCleane, Max K. Moorhead, William J. Moorhead, James H. McCutcheon, James McCutcheon, James H. Lindsay, and Nathan W. McDowell.

**The American Dredging Company**, at their annual meeting December 15th, elected the following Board of Directors: Isaac Alberston, Samuel Castrer, Jr., Alexander Purves, Henry R. Towne, Washington Jones, James Simpson, Joseph M. Naglee, Beauveau Borie, Edward J. Heraty. The Directors organized by electing these officers: President, Isaac Albertson; Secretary and Treasurer, Floyd H. White.

**Soldiers Home.**—The Board of Managers of Michigan Soldiers' Home will receive sealed schedule bids for the erection and construction of Soldiers' Home, to be located at Grands Rapids, Kent Co., Michigan. Bids must be in by 12 M., January 6th, 1886. All bids or proposals must be submitted in detail schedule form for a lump sum, and must be enclosed in sealed envelopes and addressed "Col. Samuel B. Wells, Manager, Michigan 'Soldiers' Home,' Grand Rapids, Mich."

**Old Project Revived.**—WATERLOO, Iowa.—December 14th.—An attempt is being made to revive the old project of the Iowa Midland extension of the Northwestern from Anamosa to Eagle Grove, by way of Laporte City. A corps of surveyors has been in the field for several days, and was within a few miles of the latter place today. The scheme is being pushed by citizens of Laporte, but it is claimed that the Northwestern is backing the project.—St. Paul and Minneapolis *Pioneer Press.*

**Proposals for Cast-Iron Water Pipes.** Boston; Mass., will receive proposals until 12 o'clock M., of Tuesday, the 29th day of December, 1885, to be indorsed "Proposals for Cast Iron Pipes for the Boston Water Works."

The estimate of quantities required and by which the bids will be compared is as follows:

25 tons 4-inch pipe, Class B.
650 tons 6-inch pipe, Class B.
270 tons 8-inch pipe, Class B.
370 tons 10-inch pipe, Class B.
700 tons 12-inch pipe, Class B.
100 tons special castings.

Specifications may be obtained and plans seen at the office of the City Engineer, City Hall, Boston.

**Minneapolis Bridge Bids.**—At the regular session of the Minneapolis common council, December 16th, the committee on roads and bridges reported the bids for the stone work on the abutments and piers of the stone arch bridge, which were as follows:

A—Stone dressed at the quarry.
B—Stone dressed at Minneapolis.
C—Bids for setting the stone—all figures given meaning the price per cubic yard for the work.

| Bidders. | Class A | Class B | Class C |
|---|---|---|---|
| J. H. Nevins, stone in rough, delivered | $6.75, | $ 8.75 | $ 9.25 $14.25 |
| Patrick Davnack | | 22.00 | 12.00 15.00 |
| Minnesota Stone Co., masonry complete | | 10.25 | 12.25 3.75 |
| Bruce & Barron, masonry complete | | | 13.36 |
| Bing & Tobin | | 11.25 | 11.95 14.00 |
| Lauer Bros. | | 12.22½ | 13.34 |

According to the price mentioned in the bid of Tobin & Bing for constructing the piers and abutments of the new stone arch bridge, the total cost of that portion of the work will be $78,000. This will include the masonry for two abutments and three piers, and half, or forty feet, of the arch on the piers. The excavation for the foundation will be done by the city under the direction of Engineer Rinker.

**The Repaving of Broadway.**—At a meeting of the Broadway, (Brooklyn) Property Owners' Association, held Dec. 10, at 709 Broadway, with Mr. Henry Batterman in the chair, it was announced that the Broadway Railroad Company would not contribute more than $5,000 toward paying for the repaving of the thoroughfare from Eleventh street to the city line with granite block pavement. Reports from all along the line indicated that property owners generally were in favor of the proposed repavement and would bear their share of the expense.

**New Jersey Rivers and Harbors.**—WASHINGTON, December 16th.—The Chief of Engineers, in his estimates for the improvement of rivers and harbors, asks for New Jersey this year the following appropriations: Channel between Staten Island and New Jersey, $50,000; Keyport Harbor, $35,000; Raritan Bay, $10,000; Cheesequake Creek, $5,000; Mattawan Creek, $9,000; Manasquan River, $25,000; Maurice River, $35,000; Passaic River, $130,000; Raccoon River, $16,000; Rancocas River, $22,000; Raritan River, $100,000; Shrewsbury River, $50,000; South River, $25,000; Woodbridge Creek, $10,000; Woodbury Creek, $10,500; examination of changes and re-surveys of the Jersey coast, $2,000.

**Lake Erie and Ohio River Canal.**—AKRON, Ohio, Dec. 19,—John B. Gregory, ex-engineer of the State Board of Public Works, and Dwight Paul, formerly engineer of the northern division of the Ohio Canal, have just made a survey of the Muskingum river, 100 miles of which is used for the lower division of the Ohio Canal. The survey was made in pursuance of an act of the last Congress looking to the improvement of the Ohio River, and the object of it, the engineers say, is to change the Ohio Canal into a ship canal connecting Lake Erie with the Ohio River. The Muskingum river, it is said, can be changed into a ship canal at comparatively small expense. Its locks are already large enough, being 175 feet long and 36 feet wide. They would merely require to be made much deeper. By means of dams, slack-water can be made to reach Trenton, Tuscarawas county, 106 miles from Cleveland. From Trenton to Cleveland the Ohio Canal would have to be widened and deepened, and the locks entirely torn out and rebuilt. The entire expense is estimated at $10,000,000. The only difficulty is in getting over the Portage Summit," but water could be brought from the Cuyahoga river. The whole matter will come up before the next Ohio Legislature.

If the Ohio Canal is converted to this use, the route from New York would be via the Erie Canal, Lake Erie the Ohio Canal, the Muskingum river, and thence by the Ohio and Mississippi rivers to the Gulf.

Gen. A. J. Warner, it is said, will urge the project on the attention of Congress.

**A Draft on the Czar.**—The following story is going the rounds of the press, and is somewhat characteristic of its hero, who is one of the firm credited with a great South American Concession.

John C. Christian, a lawyer of Chicago, transacted the major portion of Mr. H. H. Honoré's legal business during the dark days of 1873. Mr. Christian came into some notoriety in the Prohibition Convention at Pittsburg last year by nominating John Peter St. John for the Presidency.

Prior to the panic of 1873 Mr. Honoré held about $9,000,000 or $10,000,000 of Chicago property, on which he owed about $5,000,000, and no man in Chicago had better credit. He carried a bank account in St. Louis, where he also had the confidence of the wealthy capitalists. During the squeeze of 1873, and near the first of the year, he was in St. Louis, and was in conversation with the President of the bank with which he did business.

"Mr. Honoré," said the banker, "your account is overdrawn here some $2,500, and as it is near the first of the year we would be exceedingly obliged if you would balance the same to-day."

"It is impossible and out of the question for me to do it to-day, and the probabilities are that it will be many more days before I can," returned Mr. Honoré.

"Well," says the banker," can't you give a note, draw a draft, do something, just so the book-keeper can balance the books?"

"Draw a draft! Who the d——l would I draw a draft on? I might as well telegraph the Czar of Russia for funds as to draw a draft."

"Well, Mr. Honoré, draw a draft on the Czar; that will square the books, and that's the main thing just now."

So, after some conversation, a sight draft for the amount was regularly drawn and started on its mission, and the proper credit given Mr. Honoré. The draft passed through many banking firms in this and the old country, and by the time it reached the Czar had many blue ribbons and seals, belonging to the different institutions through which it passed.

It was presented to the Czar through one of his agents, who desired instructions what to do with it. The Czar looked it over, but could not understand how he came to owe money to Mr. Honore, but as everything appeared regular, he instructed that it be paid, but told his secretary to inform Mr. Honoré the next time he drew a draft to send an itemized bill.—*Kansas City Times.*

## Recent Patents.

**Automatic Railway—Track Inspector.**—*P. C. Compton, Ames, Iowa.* The frame carries a revolving cylinder and gear wheel on a rotating and sliding shaft, gearing with a shaft having an ordinary flange wheel, which runs on the rail. There are four pencils which mark on paper wound on the cylinder. No. 331,684.

**Cable Railway.**—*Renaldo Solano, Brooklyn, N. Y.* The yokes of the conduit are formed of vertical and diagonal plates and braces rivetted together, with brackets to support the rail stringers. A curvilinear conduit contains a system of rollers and pulleys. A gripping apparatus is also specified. Nos. 331,834 to 331,838.

**Combined Railway Track Gauge and Level.**—*D. H. Rhodes, Topeka, Kan.* The rod has one fixed and one adjustable head and a curved T head. A scale and spirit level are added. No. 331,329.

**Coupling for Railroad Rails.**—*Henry C. Burkhead, Hardin Springs, Ky.* The rail flange has notches which receive projections from a plate on which the rail ends meet, the rail flanges and base plate rest in a covering plate with grooves to receive spikes and prevent creeping. No. 331,612.

**Dredger.**—*John N. S. Williams, San Francisco, Cal.* A rotary cutter is attached to the end of the boom, and communicates with a suction pipe by which the muck is carried to the scow. The boom is pivotted on the dredger and suspended from a jib. The cutter is worked by bevel gearing. No. 331,929.

**Locomotive.**—*Francis W. Johnstone, Mexico, Mexico.* Designed to increase the tractive power. Six wheels under the boiler and six under the tender are driven by two pairs of cylinders. The motion of the piston rods is conveyed to the connecting rods by vertical rocking beams. No. 331,973.

**Method of Tunneling and Sinking Shafts.**—*C. Sooysmith, Chicago, Ill.* The method consists in freezing the ground adjacent to the excavation, by means of pipes, through which a freezing mixture is circulated. Nos. 331,656,331,657.

**Suspension Railway.**—*John A. Enos, Peabody, Mass.* From an elevated structure on which runs a truck, a car is suspended by a suitable hanger, being steadied by wheels bearing on the upper and lower edges of the structure. Nos. 331,387 to 331,389.

# Market Report of Engineering Materials.

**New York, December 24, 1885.**

NOTE.—The following Market Report gives wholesale prices on the New York Market unless otherwise stated. It is intended as a general guide to the estimating engineer. We give it with this caution, that, as is well understood in business transactions, the amount of bill, distance from market centre and conditions of payment will have a material influence on the final paying prices.

### IRON.

| | | | |
|---|---|---|---|
| STRUCTURAL IRON. | | | |
| Angles | | 1.90 @ | 2.00 |
| Tee | | 2.25 @ | 2.35 |
| Beams and channels American | | 3.0c. @ | |
| Tank | | 2. @ | 2.1c |
| Shell | | 2.4c. @ | 2.5c |
| Steel plates, Tank | | 2½c. @ | |
| WROUGHT-IRON PIPE.. PITTSBURGH. | | | |
| Butt welded, black | Discount | 42½ @ | 45 |
| " " galvanized | " | 32½ @ | 35 |
| Lap welded black | " | 60 @ | 62½ |
| " Galvanized | " | 45 @ | 42½ |
| Boiler tubes | " | 55 | |
| RAILS. | | | |
| Steel (large lots at mill) | | 34.00 @ | 35.00 |
| Old rails | | 19.00 @ | 20.00 |
| Old rail steel | | 19.00 @ | 20.00 |
| R R. spikes | | 2.25 | |
| R R. splice-plates | | 1.70 @ | 1.75 |
| R R. Track Bolts Square Nuts | | 2.75 | |
| Barb-wire fencing, galvanized | | | 4.75 |
| " " painted | | | 3.75 |
| Corrugated iron | | | |
| Nails | | | |
| Iron, per keg | | 2.65 @ | 2.75 |
| Steel do. | | 2.50 | |

### METALS.

| | | |
|---|---|---|
| COPPER. | | |
| Lake Superior | 11.30 @ | 11.50 |
| Other Brands | 10.25 @ | 10.50 |
| LEAD. | | |
| Com. Domestic | | 4.60 |
| Lead Pipe | .06¾ | |
| Tin-Lined Lead Pipe | .15 | |
| Sheet Lead | .07¼ | |
| ZINC. | | |
| Sheet | 5.30 @ | 5.60 |

### BRICK.

| | | | |
|---|---|---|---|
| Cargoes afloat) | | | |
| Haverstraw | per M. | $6.00 @ | 6.25 |
| Fishkill | | | |
| Up-River | | 5.75 @ | 6.25 |
| Jerseys | | 5.50 @ | 6.00 |
| Long Island | | | |
| " pale | | 2.75 @ | 3.50 |
| FRONTS. | | | |
| Croton, red | | 11.00 @ | 14.00 |
| " dark | | 11.00 @ | 14.00 |
| " brown | | 10.00 @ | 13.00 |
| Philadelphia pressed | | 24.00 @ | 25.00 |
| Trenton " | | 24.00 @ | 25.00 |
| Baltimore " | | 37.00 @ | 41.00 |
| Buff " | | 33.00 @ | 35.00 |
| Enameled English | | 65.00 @ | 130.00 |
| " American | | 85.00 @ | 120.00 |
| Fire brick | | 25.00 @ | 45.00 |

### CEMENT.

The following price current is made up entirely from quotations furnished us directly by the firms dealing in each brand; the prices are understood to be wholesale in New York, subject to such special rates as large quantities may warrant:

| | | | |
|---|---|---|---|
| BAETJER & MEYERSTEIN: | | | |
| Hanover Portland | | $2.60 @ | $2.65 |
| BELLONI & Co.: | | | |
| Hemmoor "Crown" brand | | | 2.50 |
| JAMES BRAND: | | | |
| K. B. & S | | 2.55 @ | 3.00 |
| BROOKS, SHOOBRIDGE & Co. | | 2.45 @ | 2.60 |
| HOWARD FLEMING: | | | |
| Gibbs' English Portland, 400 lbs | | 2.65 @ | 2.90 |
| K. B. & S. " " | | 2.75 @ | 2.95 |
| Stettiner, German | | 2.65 @ | 2.85 |
| Lagerdorfer, " | | 2.45 @ | 2.75 |
| Fieve, A 1, Belgian | | 2.35 @ | 2.50 |
| Roman | | 2.75 @ | 3.00 |
| Keene's Coarse | | 4.75 @ | 5.50 |
| " Fine | | 7.75 @ | 8.50 |
| " Superfine | | 8.50 @ | 10.00 |
| FISHER, ERSKINE W.: | | | |
| Stettin (German) Portland Cement | | $2.40 @ | 2.75 |
| GABRIEL & SCHALL: | | | |
| Vorwohler "Lion" | | 2.65 @ | 3.10 |
| HUDSON RIVER CEMENT CO. Rosendale | | | 1. 0 |
| JOHNSON & WILSON: | | | |
| Saylor's American Portland | | 2.15 @ | 2.40 |
| LAWRENCE CEMENT CO.: | | | |
| Hoffman Rosendale | | | |
| LESLEY & TRINKLE, Philadelphia, Pa.: | | | |
| "Giant" Portland | | 2.20 @ | 2.40 |
| Improved "Union" | | 1.25 @ | 1.50 |
| Union | | 1.10 @ | 1.20 |
| MARCIAL & Co.: | | | |
| J. B. White & Bros. Coarse | | 4.50 @ | 5.00 |
| " Fine | | 8.00 @ | 10.00 |
| " Portland | | 2.45 @ | 2.85 |
| NEW YORK CEMENT CO.: | | | |
| Rosendale | | | 1.20 |
| N. Y. & ROSENDALE CEMENT CO.: | | | |
| Rosendale, "Bridge" brand | | | 1.10 |
| SINCLAIR & BABSON: | | | |
| Alsen's Portland | | 2.45 @ | 2.75 |
| K. B. & S. | | 2 35 @ | 2.60 |
| STANDARD CEMENT CO. | | | |
| E. THIELE: | | | |
| Dyckerhoff | | 2.90 @ | 3.25 |
| UNITED STATES CEMENT CO.: | | | |
| Windsor | | 1.00 @ | 1.10 |
| Standard | | | 1.15 |
| Cable's Portland | | 2.15 @ | 2.40 |
| UNION AKRON CEMENT CO.: | | | |
| Akron "Star" brand | | | |

### ASPHALT.

| | | | |
|---|---|---|---|
| Prices range per ton | | $15.00 @ | 20.00 |
| According to quantity or brand, and whether taken from vessel or store. | | | |

### LIME.

| | | | |
|---|---|---|---|
| Rockland, common per bbl | | 1.00 | |
| " finishing | | 1.20 | |
| State, common | | .90 | |
| " finishing | | 1.10 | |
| Kingston, ground | | 95 @ | 1.00 |
| Add 25c. to above figures for yard rates. | | | |

### STONE.

*Cargo rates at New York.*

| | | | |
|---|---|---|---|
| Amherst freestone, No. 1 | per cub. ft. | 0.90 @ | 0.95 |
| " " No. 2 | " | 0.75 @ | 0.80 |
| " " light drab | " | 0.80 @ | 0.95 |
| Berlin " in rough | " | 0.75 @ | 1.00 |
| Berea " " | " | 0.75 | |
| Brown stone, Portland, Ct. | " | 1.00 @ | 1.30 |
| " Belleville, N. J. | " | 0.75 @ | 1.25 |
| Granite, rough | | 0.60 @ | 1.25 |
| Common building stone per load | | 2.00 @ | 3.00 |
| Base stone, from 2¼ to 6 ft. lengths, per lin. ft. | | 0.40 @ | 3.00 |

### SLATE.

| | | | |
|---|---|---|---|
| Purple roofing | per square | 6.00 @ | 7.00 |
| Green " | | 6.00 @ | 7.00 |
| Red " | | 15.00 | |
| Black Penna. (at New York) | " | 4.50 @ | 5.00 |

### LUMBER.

Prices for yard delivery in New York.

| | | | |
|---|---|---|---|
| PINE, Common box | per M. | 18.00 @ | 20.00 |
| Choice " | | 65.00 @ | 70.00 |
| Tally plank, 1¼ in. 10 in. dres'd. each. | | .44 @ | .50 |
| Tally boards, dressed com. " | | .28 @ | .30 |
| SPRUCE, Boards dressed " | | .25 @ | .28 |
| Plank, 1¼ in " | | .28 @ | .30 |
| " 2 in. " | | .38 @ | .40 |
| " 2 in. dressed " | | .43 @ | .45 |
| Timber | per M. | 20.00 @ | 22.00 |
| HEMLOCK, Boards | each. | .18 @ | .20 |
| Joist, 2¾ × 4 to 4 × 6 in | " | .16 @ | .44 |
| OAK | per M. | 55.00 @ | 65.00 |
| CYPRESS 1, 1¼, 2 and 2½ in | " | 35.00 @ | 40.00 |
| YELLOW PINE, Girders | " | 25.00 @ | 30.00 |
| Dressed flooring | " | 28.00 @ | 35.00 |
| SHINGLES, Extra shaved pine, 16in. | " | | |
| " sawed 18 in. | " | 5.75 @ | 6.00 |
| LATH, Cargo rate | " | | 2.30 |

### PAINT.

| | | | |
|---|---|---|---|
| Lead, white, American dry per lb | | .04¾ @ | .05 |
| " " in oil pure | " | .05½ @ | .06 |
| English, B. B. in oil | | .06¾ @ | .08¾ |
| Red, American | | .05¼ @ | .05½ |
| Litharge | " | .05 @ | .05½ |
| Venetian red, American | " | .01 @ | .01¾ |
| Indian red | " | .05 @ | .10 |
| Vermillion, American lead | " | .11 @ | .11¾ |
| Paris green | " | .15 @ | .20 |
| Umber, Amer. raw and powdered per lb. | | .01¾ @ | .01¾ |
| Drop black, Amer. | | .07 @ | .13 |
| " Eng. | | .11 @ | .13 |
| Chrome green | | .05 @ | 20 |
| Oxide zinc, American | | .03¾ @ | .04 |
| " " French | | .04¾ @ | .04 |